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Administration Report of the Director of Agriculture for the year 1938.

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REPORT OF THE DEPARTMENT OF AGRICULTURE FOR THE YEAR 1938.

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DEPARTMENT OF AGRICULTURE.

Administration Report of the Director of Agriculture for the year 1938.

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I.—AGRICULTURAL EXPORTS.

Weather conditions were very unfavourable for the sugar industry in particular and the total value of the agricultural exports for the year 1938 amounted to £1,814,462 as against £2,329,782 in the preceding year and £2,066,263 in 1936.

2. Compared with 1937, the exports of sugar and its by-products fell in value from £1,338,692 to £1,074,316 ; cocoa rose in quantity but, due to low prices, the value fell from £643,123 to £493,601 ; coconuts and by-products fell from £136,068 to £89,039 ; grapefruit and oranges and their canned products increased in value from £51,406 to £89,021 while the minor crops—coffee, tonka beans, lime oil and bananas—showed a falling off in total values. Detailed figures for the years 1937 and 1938 as well as the average of the three years 1926-28—a period prior to the world-wide trade depression—are given below :—

Agricultural Exports.

Article.	1926-1928 average yearly value.	1937 value.	1938 value.
	£	£	£
Sugar and by-products	1,014,677	1,338,692	1,074,316
Cocoa	1,531,148	643,123	493,601
Coconuts and Coconut products	223,768	136,068	49,039
Coffee	12,833	28,074	8,438
Limes and Lime products	6,056	54,148	34,717
Grapefruit and Oranges	2,028	42,752	71,905
Grapefruit and Orange juices	...	8,654	17,116
Bananas	...	16,027	9,174
Tonka Beans	1,824	21,593	17,463
Pulses, Beans and Peas	4,816	1,737	34
Livestock and Hides	8,441	4,608	4,803
Bitters	76,862	23,537	23,914
Miscellaneous	20,192	10,769	9,942
	£2,902,645	£2,329,782	£1,814,462

3. The year has been one of distressingly low prices for agricultural produce, except tonka beans, and in order that a true perspective may be obtained of the financial difficulties that the agriculturists have had to face, a table is given below in which prices of the three staple crops of the colony are compared for four periods dating back to 1911-1913 :—

	Cocoa.	Sugar.	Copra.
	Per bag (165 lb.)	Per ton f.o.b.	Per ton f.o.b.
	$ c.	£ s. d.	£ s. d.
Pre-War (1911-1913)	19 29	14 10 0	21 7 6
Boom Years (1919-1921)	33 15	30 7 0	40 12 6
Pre-depression (1926-1928)	21 00	15 10 0	21 0 10
Current (1938)	10 06	8 9 0	*9 0 0

* Local price, not f.o.b. includes 25 per cent. bonus.

4. It is not unreasonable that primary producers should feel that they have a claim to higher prices to-day than obtained prior to the Great War in view of the fact that the cost of living, of labour, and of supplies have all increased since that time.

SUGAR.

5. For several years in succession including the present year under review, the sugar industry has taken the place of cocoa as the leading agricultural industry of the colony. The production of sugar in 1938 amounted to 133,627 tons as against 154,285 tons during the preceding year. The shortage of about 20,000 tons was due primarily to exceptional rains during the harvesting season. Transport presented unusual difficulties ; and in certain areas field and Crown traces were impassable for long periods. There was also some unrest among both cane farmers and factory hands. Most regrettably the colony could not fill its export quota in the first year of the International Sugar Agreement.

Sugar Production.

6. The production figures for the past ten years are given below :—

	Tons.
1929	89,926
1930	79,848
1931	98,573
1932	97,598
1933	120,763
1934	105,342
1935	117,780
1936	154,665
1937	154,285
1938	133,627

7. In addition to the amount exported, some 12,000 tons of sugar are consumed locally.

Exports and Values of Sugar and Sugar by-products.

8. The quantities and values of the exports of sugar, rum and molasses for the years 1929-1938 are given below.

	Sugar.		Molasses.		Rum.		Prices Grey Crystals f.o.b. per ton.
	Exports.	Value.	Exports.	Value.	Exports.	Value.	
	Tons.	£	*Gals.*	£	*Gals.*	£	£ s. d.
1929 ...	81,503	1,049,863	1,373,420	18,227	73,841	13,639	11 10 0
1930 ...	69,138	776,167	899,051	11,238	72,063	14,313	10 5 0
1931 ...	86,054	902,990	1,599,414	15,924	86,260	15,719	9 0 0
1932 ...	85,956	845,974	2,701,921	14,697	139,540	27,521	9 14 2
1933 ...	108,516	1,115,567	3,026,077	31,634	63,907	12,853	9 10 0
1934 ...	93,513	916,232	2,310,381	24,115	50,977	11,488	8 13 10
1935 ...	105,699	942,171	3,199,524	32,226	6,282	3,328	7 12 6
1936 ...	142,671	1,276,579	3,909,009	41,623	90,185	20,449	7 14 7
1937 ...	142,747	1,274,019	4,258,934	45,953	109,860	18,720	9 2 6
1938 ...	120,258	1,032,908	2,523,645	29,050	63,051	12,358	7 10 0

Prices of Sugar.

9. World values of sugar continued to be low and the f.o.b. price of grey crystals from 1st January to 30th June averaged £7 10s. per ton. From the above table it will be seen that for the past eight years the f.o.b. price of sugar has been below £10 per ton.

Cane Farming Industry.

10. About 17,500 cane farmers, the greater proportion of whom are East Indians, supplied 573,599 tons or 44 per cent. of the total canes ground by the factories as against 629,881 tons in 1937. At a basic price of 11/- per ton, the cane farmers received $1,514,301 as compared with $1,663,885 for the preceding year. Payment to farmers are now made in accordance with a schedule of prices fixed by the Legislative Council on the recommendations of a Committee appointed by Government for the purpose of determining an equitable price for farmers' canes.

11. The Cane Farming Control Ordinance which aims at maintaining the balance that existed between estate grown canes and farmers' canes prior to the International Sugar Agreement, was revised towards the end of the year.

Importance of Sugar Industry.

12. Owing to the decline in the value and production of cocoa in recent years, the sugar crop has played an important part in mitigating the economic difficulties of the agricultural labourer.

COCOA.

13. In 1938 the quantity of cocoa exported was 42,436,447 lb. as compared with 26,258,622 lb. in 1937, and the value was £493,601 in 1938 as against £643,123 in 1937.

14. Exports and prices during the 10 years, 1929 to 1938 were as follows :—

	Exports. lb.	*Value.* £	*Price per fanega* (110 lb.)* £ s. d.
1929	61,888,740	1,446,127	2 5 9½
1930	53,825,120	1,136,056	1 18 11
1931	57,186,512	826,333	1 8 8
1932	41,822,127	579,170	1 8 11
1933	51,311,274	555,907	1 0 11½
1934	26,803,149	349,694	1 6 10
1935	44,387,836	527,212	1 3 11½
1936	28,339,195	487,578	2 2 9½
1937	26,258,622	643,123	2 6 1
1938	42,436,447	493,601	1 3 4½

* Monthly average.

Prices.

15. Although exports in 1938 exceeded those of 1937 by 16,177,825 lb., the value was £149,522 less owing to the disappointing return to the low level of prices that have obtained for some years past, with the exception of the temporary revival in 1936 and 1937. Cocoa market prices are now less than half what they were prior to the Great War or during the years 1926-1928 that preceded the world-wide trade depression.

Witchbroom.

16. Witchbroom was in greater evidence owing to weather conditions and the disease continues to be a serious menace to the cocoa industry especially in certain areas. The cocoa crop at Marper Estate reached its highest yield since the property was taken over by Government in 1929, which points to the fact that witchbroom can be kept within reasonable check provided funds are available. The amount required is not more than $3 to $5 per acre, but the prevailing low prices for cocoa do not allow of the necessary control measures on the majority of estates.

Expedition in search of witchbroom resistant strains of cocoa.

17. Dr. F. J. Pound, Agronomist, made a second expedition to South America in November, 1937 and returned to the colony in May. On this occasion the search for strains resistant to witchbroom was carried out in the Amazon Valley, Peru and Colombia. His report has been published and the Secretary of State has commended Dr. Pound on his work. Funds for the expedition were contributed jointly by the Goverment and the Colonial Development Committee.

18. Although witchbroom was prevalent along the Amazon and its tributaries, Dr. Pound succeeded in discovering patches of cocoa entirely free of the disease in close proximity to heavily infected trees. Planting material was collected and sent to Barbados for propagation under quarantine for which our thanks are due to the Government and the Department of Agriculture of that colony. Budwood has already been brought to Trinidad and young plants have been raised at the St. Augustine Nurseries in St. Joseph and are now being tested at the Marper Estate in Manzanilla for disease resistance under local conditions.

Cocoa Subsidy.

19. The year 1938 was the third year of the Cocoa Subsidy and additional grants over and above the ordinary subsidy were made by Government bringing the total disbursements to £90,365 as compared with approximately £76,041 in 1937 and £74,833 in 1936. Increased employment was thereby provided for labourers.

COCONUTS.

20. There was a heavy decline in the production of coconuts during the year. The exports of nuts, copra and oil, converted into terms of nuts, amounted to 31,549,535 nuts with a value of £49,039 as against 57,747,999 nuts with a value of £136,068 in 1937.

21. Exports of coconuts, copra and coconut oil for the past 10 years are given below :—

	Coconuts.		Copra.		Coconut Oil.		Price of Copra.
	Exports.	Value.	Exports.	Value.	Exports.	Value.	
	Nuts.	£	*lb.*	£	*Gals.*	£	100*lb.*
1929	13,608,118	66,320	23,979,882	209,732	34,707	5,403	17s.
1930	5,886,127	25,830	21,891,259	175,965	41,154	5,938	14s.
1931	4,487,875	12,549	19,484,808	101,148	20,702	1,818	8s. 9d.
1932	3,847,245	12,822	15,418,906	91,444	26,461	2,520	10s. 2½d.
1933	7,888,980	21,406	19,357,980	45,945	45,565	3,658	9s. 5¼d.
1934	9,850,299	29,128	17,928,775	57,451	31,118	2,244	5s. 10d.
1935	5,376,290	14,393	8,764,646	34,682	14,879	1,339	8s. 6½d.
1936	4,560,180	14,529	9,438,240	51,798	9,437	1,343	11s. 5½d.
1937	5,020,665	20,693	17,277,008	113,083	19,918	2,292	11s. 11½d.
1938	2,245,302	6,786	9,387,616	40,463	20,919	1,790	6s. 4½d.

Bonus to Copra Producers.

22. Under the terms of the agreement between Government and the Oil Factories, bonuses amounting in all to £19,965 were distributed to producers of copra.

Prices of Copra.

23. The copra market ranged between $1.30 to $2.50 per 100 lb.

Coconut Wilt.

24. This disease continues to take a toll of coconut palms but has never been found to occur on plantations on the marine alluvium of the coastal belt that are ideal for the cultivation of coconuts.

LIMES AND LIME PRODUCTS.

25. The total value of the exports of lime oil, lime juice, citrate of lime, and green limes was £34,717 (of which £24,592 was the value of the lime oil) in 1938 as against £54,148 in 1937.

Exports of Limes and Lime Products.

	Exports.	*Value.*
Lime Oil.	*Gals.*	£
1929	797	9,516
1930	1,647	19,457
1931	2,413	32,071
1932	929	12,840
1933	1,889	22,575
1934	2,882	25,055
1935	1,949	15,497
1936—Distilled	22,016 lb.	17,702
—Handpressed	779 lb.	1,430
1937—Distilled...	46,429 lb.	46,075
—Handpressed	1,222 lb.	2,023
1938—Distilled...	33,403 lb.	22,904
—Handpressed	938	1,688

Lime Juice.

	Concentrated Juice.		Raw Juice.	
	Exports.	Value.	Exports.	Value.
	Gals.	£	*Gals.*	£
1929	55,455	11,562	Nil	Nil
1930	21,762	3,759	47,554	4,096
1931	4,012	458	22,931	2,007
1932	8,583	427	46,629	4,250
1933	11,709	622	17,375	1,203
1934	9,110	535	3,479	294
1935	4,422	393	11,807	806
1936	3,521	321	66,881	4,758
1937	5,780	491	25,082	1,609
1938	2,640	253	74,752	4,667

Citrate of Lime.	*lb.*	£
1932	54,217	424
1933	52,800	389
1934	96,693	641
1935	104,037	901
1936	23,716	169
1937	203,728	2,358
1938	200,332	3,438

Green Limes.	*Barrels.*	£
1932	189	145
1933	2,102	2,381
1934	1,439	1,991
1935	565	801
1936	1,391	2,472
1937	923¾	1,592
1938	1,039	1,767

GRAPEFRUIT AND ORANGES.

Exports and Values.

26. The exports and value of grapefruit for the past ten years are as follows :—

	Exports.	*Value.*
	Boxes.	£
1929	807	606
1930	2,184	910
1931	4,377	1,874
1932	10,973	8,978
1933	3,433	2,586
1934	23,518	18,634
1935	51,119)	42,473
loose fruit	7,724)	
1936	42,958	41,357
1937	45,210)	39,078
loose fruit	27,186)	
1938	79,660	66,300

27. Export of oranges amounted to 3,697,562 valued at £5,605 in 1938 compared with 3,116,970 valued at £3,674 in 1937.

COFFEE.

28. The year was a poor one for coffee. For the past ten years the quantities and values of coffee exports have been as follows :—

	Exports. *lb.*	*Value.* £
1929	817,983	32,309
1930	491,988	12,525
1931	857,920	16,276
1932	908,492	20,822
1933	339,196	7,416
1934	525,115	10,595
1935	1,187,867	18,290
1936	1,213,184	17,702
1937	1,752,882	28,074
1938	687,731	8,438

TONKA BEANS.

29. Tonka bean exports in 1938 showed a decrease compared with the two previous years.

30. The exports and value for the past ten years are as follows :—

	Exports. *lb.*	*Value.* £
1929	15,266	2,544
1930	9,219	1,538
1931	22,950	3,583
1932	69,276	12,993
1933	9,979	3,004
1934	45,450	14,822
1935	37,968	12,320
1936	92,719	31,002
1937	71,539	21,593
1938	52,656	17,463

BANANAS.

31. Under the agreement with the Canadian Banana Company, a total of 80,506 bunches valued at £9,174 were exported in 1938 compared with 157,740 bunches valued at £16,027 in 1937.

32. Cercospora leaf spot continues to be serious and has been the main factor in preventing an expansion of the banana industry. Fifty-one thousand two hundred and twenty-two bunches were purchased but not shipped owing to lack of space.

II.—DEPARTMENTAL INSTITUTIONS, DISTRICT WORK, AND OTHER ACTIVITIES.

DEPARTMENTAL INSTITUTIONS.

River Estate.

33. The work at River Estate is fully described by Mr. R. O'Connor, Manager, and Dr. F. J. Pound, Agronomist, in their reports in Part II. Dr. Pound is responsible for the organization of the crop investigations.

34. Cocoa continues to be the main interest, and considerable advance has been made in the selection and propagation of high yielding clones, and planters are showing a great interest in these selections even though they are susceptible to witchbroom disease. Arrangements have been made to establish acre plots of these selections in different localities to serve as nuclei for future budding on estates. Some young trees, not yet 5 years old on chocolate soil, have shown phenomenal growth and very promising crops.

35. Development of the scientific side of River Estate continues and the Agronomist is engaged in changing its status more and more to that of an Experiment Estate. In co-operation with the Research Staff of the Imperial College of Tropical Agriculture, several areas are being replanted with high yielding clonal material of cocoa for definite experiments. Experiments on citrus, bananas, coffee and tonka beans are also being increased.

36. Fertiliser experiments continue to show the outstanding benefit of potash fertilisers on a soil which contains less than 60 parts per million of potash in the top 6 inches ; and not only are large yield increases obtained during the period of fertilising but the residual effects shown afterwards are striking. Pen manure continues to be very beneficial, but phosphates are only beneficial when the potash status is good, and sulphate of ammonia is detrimental to yields unless the overhead shade is inadequate.

37. The rehabilitated Field 2, in which rehabilitation was carried out between 1919 and 1924 has shown that the 48 per cent. of pickets which up to 1919 produced 4 per cent. of the crop, when replaced by progeny of heavy yielders were responsible for 44 per cent. of crop fifteen years later.

38. Rehabilitation of Fields 13 and 16 with an addition of potash and phosphate fertilisers for two years has resulted in yields of 2·7 bags per acre in 1936 jumping to 5·1 bags per acre in 1938.

39. Experiments involving pruning, draining and manuring have clearly demonstrated the great value of manuring in combination with the other operations.

Marper Estate.

40. The routine work of Marper Experiment Station has continued and the very creditable average yield of 3·3 bags per acre was obtained, a record in the history of the estate. An interesting correlation has come to light connecting rainfall (or lack of rainfall) with the crop of the following calendar year. On both occasions where the graph of yield shows a peak, the rainfall in the preceding year was abnormally low.

41. Elsewhere in the report mention is made of the introduction of promising strains of cocoa selected by Dr. F. J. Pound in South America for trial for resistance to witchbroom. In order to enlarge the testing nursery at Marper Estate without closing down the cultural and fertiliser experiments there, Government purchased 16 acres of a neighbouring property. The testing nurseries now have a capacity of 30,000 pickets. The bulk of this area will be planted during 1939.

42. Witchbroom control was continued and diseased tissues were cut off once every three months. During the year 568,843 brooms and 21,452 diseased pods were removed. The cost was $5.19 per acre without allowing for supervision. Records have been kept since 1932 that show the percentage loss of mature pods :—

Year.	*Loss of mature pods. per cent.*
1932	... 0.87
1933	... 1.25
1934	... 1.33
1935	... 1.31
1936	... 3.84
1937	... 8.67
1938	... 3.51

42. The Agronomist in his report describes the fertiliser experiments at Marper in detail. As on other cocoa soils, nitrogen was not beneficial.

St. Augustine Nursery and Experiment Station.

43. Mr. E. J. Gregory, Manager of the Experiment Station at St. Augustine, was transferred to Uganda in March.

44. The opportunity was taken of recommending to Government that the management of the practical work of both the Nursery and the Experiment Station should be under one officer and that a Citrus Specialist should be appointed from the staff of the Department and given, as one of his duties, direct responsibility for supervision of the experimental work at the Station which is mainly concerned with the study of grapefruit, oranges and limes.

45. This scheme was put into operation pending its formal approval by Government and Mr. F. Buthn became responsible for the practical work and Mr. F. M. Bain, prior to his departure on study leave, for the scientific work. Mr. Buthn's report on the two institutions will be found in the second part of this report.

St. Augustine Nursery.

46. In 1938, 206,707 plants were distributed from the Nurseries. There was a decrease of 63,193 as compared with 1937 owing to a reduction in the number of cocoa seedlings taken by the Cocoa Subsidy Board. Nearly 20,000 decorative plants were distributed, being an increase over the previous year. The rapidly growing demand for seedlings of garden annuals testifies to the popularity of this new service. Budded plants sold or otherwise distributed to the public numbered : 11,000 citrus, 2,212 mangoes, 1,901 avocado and 7,900 cocoa plants.

47. A special feature of the work this year was the distribution of the budded cocoa plants. The buds were selected from self-compatible high yielding strains and the plants were placed with planters on estates in the best cocoa growing areas.

48. Budwood received from Barbados from the South American cocoa strains, seeds of which were collected by Dr. Pound, together with budwood from selected local trees were budded for the purpose of providing plants for testing resistance to witchbroom.

49. Additional shelters have been erected to cope with the large number of cocoa seedlings that have been raised in recent years.

50. 6,084 West Indian lime seedlings were distributed as compared with 10,730 in 1937.

51. A new grapefruit, the " Cecily ", was imported from South Africa in 1936 and, after having been released from the Plant Quarantine Station, was planted at the Nursery.

52. Specimens of *Lonchocarpus* spp. flowered during the year and material was sent to Kew for identification.

53. The Department is indebted to the Director of Kew Gardens, Messrs. Vilmorin Andrieux & Co., France, Lieut.-Col. Wilson, Messrs. J. L. Agostini, Claud Green and S. C. Lawrence, for gifts of plants and seeds.

53. The revenue for the year amounted to $9,830.11.

St. Augustine Experiment Station.

54. The 40 acres under citrus are now some six years old and the early indications of the value of potash and pen manure on the soil have again been borne out, and it was decided to make these treatments fundamental in order to enhance the practical value of the various experiments.

55. In 1935 the plants suffered severely from scale insects owing to drought but have now largely recovered. Prior to his departure on transfer, Mr. Gregory prepared a bulletin bringing the citrus work up to date.

56. Back crosses of T.1, T.6 and T.145 of the West Indian lime were again attempted. Increased numbers of Tahiti and T.145 budded lime plants were planted at the Station in order to provide material for trial shipments of these types as green limes. Numbers of the Perrine lemon have also been planted out.

57. Nineteen new varieties of seedling canes were released from the Quarantine Station for multiplication at the Station.

58. An avocado pear plot was planted consisting of budded progeny of the trees selected by Dr. Wardlaw as bearing fruit suitable for shipment.

59. The revenue for the year was $1,129.67.

Royal Botanic Gardens and Government Grounds.

60. Mr. R. E. Dean, Curator, reports in Part II on his work for the year. His duties have been largely extended, compared with those formerly attached to the post of Curator; and he is responsible for the care of the grounds of Government Buildings in Port-of-Spain and for the planting scheme decided upon for the purpose of beautifying the approach to the city from the new Deep Water Quay by way of the Wrightson Road.

61. The Royal Botanic Gardens have been kept in good order and the area added last year to the ornamental section has added much to the general appearance of the grounds. A section to the north-east is to be similarly converted from forest to lawn during 1939. The lily ponds and the other ornamental features of the new garden at the north-west of the Savannah continue to prove popular with the public.

62. In the past it has only been possible to secure occasionally young plants of the *Amherstia nobilis*—one of the most attractive of tropical flowering trees. Mr. Dean succeeded in devising a method of propagation by binding a wire round the stem and air-layering, and several young plants were obtained.

63. The care of grounds of Government Buildings took an appreciable proportion of the time of the Curator.

64. A start was made in planting grass, shrubs and trees on the 'island' areas on the Wrightson Road. Trees of *Cassia fistula* and *Saraca tapingensis* were used.

65. Immortel seeds of different varieties were collected and shipped to a firm of manufacturing chemists desirous of investigating the alkaloid content.

66. The Royal Botanic Gardens are indebted to a long list of generous donors for plants and seeds.

Government Stock Farm and Animal Husbandry.

67. During the year under review the work of the Government Farm, which is described in detail by Capt. Metivier, Officer-in-charge, progressed satisfactorily. Early in the year Government took an important step forward in further linking the Farm with the development of the livestock industry of the colony by appointing Mr. J. L. Shannon, Assistant Officer-in-charge, to be Livestock Officer. His duties are now the encouragement of the rearing of livestock by small-holders and the dissemination of information regarding the best methods of management.

68. Three itinerant breeding units of well bred sires were moved from district to district, being stationed at Diego Martin, Tacarigua, Arima, Chaguanas, Claxton Bay, Debe, Princes Town, Penal, Sobo, Cedros, Moruga, Ecclesville and Toco.

69. Of the Farm animals, the Carnation Holstein bull has developed into a fine animal, and the Murrah water buffaloes imported from India have proved valuable additions to the herd.

70. Over 45,000 gallons of milk was produced in the year as against 33,398 gallons in 1937. "Nymph", a half-bred Holstein, held the record with 11,458 lb. of milk with a lactation period of 349 days. As usual the bulk of the milk went to the Government hospitals.

71. Importations for the year included 4 young pure bred Holstein bulls from Canada, 2 Jack Donkeys from Kentucky, 3 pure bred gilts and 1 sow from Canada and 3 British Alpine and 2 Anglo-Nubian bucks from England.

72. The Annual Sale was held on the 3rd December and realized $2,591 compared with $3,159 in 1937. The following animals were sold:—

Classes.	*Number.*	*Value.* $ c.
Cattle	23	1,446 00
Goats (pure bred)	9	320 00
Pigs	38	539 50
Poultry	78	267 50
Ducks	18	18 05
		$2,591 05

73. Educational visits were paid to the Farm by two District Agricultural Societies, eighteen schools and two Associations. As usual a number of local residents and persons from abroad interested in livestock visited the Farm.

74. The current expenditure amounted to $41,981 and the revenue to $33,109.

Sugar Cane Investigation Committee.

75. The work of the Sugar Cane Agronomist included, in the main, field experiments (manurial, cultural and varietal trials), biochemical investigations, soil studies with special reference to manurial treatment and a preliminary soil survey with special reference to the allocation of varieties. The work continues to give clean-cut results and to lead to improvements in estate practice.

76. The manurial experiments were concerned primarily with optimum size and time of application of dressings of ground limestone, inorganic nitrogen, phosphate and potash, by-products of the industry pen manure, molasses, megasse and filter-press mud) and auxiliary elements (copper and manganese). Differential response of varieties to manurial treatment has also been under measure.

77. The cultural experiments embraced such diverse problems as drainage, use of megasse as a soil mulch, spacing of plants and intensity of tillage of ratoons.

78. The number of varietal experiments has been greatly increased and the results are beginning appreciably to influence the variety situation on the sugar areas. For example, the variety Co. 213 has been shown as plant canes to give a ton of sugar to the acre more than the standard variety Uba on the red weathering clay soils of the Naparima district.

79. The biochemical investigations have been concerned with the effects of manurial and cultural treatments on crop quality and the use of manures in a manner such as to improve crop quality. These lines of work have met with a considerable degree of success.

80. As a result of soil analyses, coupled with data from field experiments, manuring with lime and potash has been placed on a scientific basis on the majority of the sugar estates.

81. During the year, with the assistance of Mr. C. F. Charter, and with the aid of a grant from the Colonial Development Fund, a preliminary soil survey of the sugar estates of the island has been made. The more important types of soil have been identified, described and classified and their laboratory examination commenced. The various types of soil have been grouped on the basis of their more important agricultural properties and recommendations have been made as to the general suitability of the soil groups to noble, hardy and intermediate varieties.

82. Details of the work on sugar cane pests, conducted by the Entomologist are given in the second part of this report.

83. Injury due to the froghopper was not particularly intense, but some 3,000 acres of cane were affected, seriously in the case of 1,100 acres. First brood populations of froghoppers were particularly high, as a result of continued rains during the dry season, but populations diminished progressively in the later broods in most districts.

84. Experiments on the use of pyrethrum dust for the control of adult froghoppers were continued and applications of this material were made on a large scale with encouraging results.

85. Liberations of the Amazon Fly parasite of the small moth borers of sugar cane were continued through the year. Recoveries of the parasite have been made in the field, but its definite establishment in the colony is still in some doubt.

FERTILISER EXPERIMENTS.

Sugar Cane.

86. Mr. P. E. Turner, Sugar Agronomist, in his report gives detailed results of the sugar cane fertiliser experiments harvested in 1938. These experiments were designed to obtain measures of the effects on yield of cane and sugar of size of dressing and time of application of lime, organic manures (Pen manure, sheep manure, filter-press mud, molasses, megasse) and inorganic manures (standard forms of nitrogen, phosphate, potash) both alone and in various combinations; also auxiliary elements (copper, manganese, &c.) The aims of the manurial experiments are to secure information of immediately practical value, to obtain an understanding of the general principles underlying the manuring of sugar cane and to study the effects of manurial treatments on the soil.

Cocoa.

87. Dr. F. J. Pound, Agronomist, was in charge of the cocoa fertiliser experiments. These included a series on private estates carried out with funds provided by the Cocoa Subsidy Board. Up to date it has been shown that :—

(1) Success with fertilisers depends on inherent vitality and health of trees.
(2) Results are quicker and more certain on well-drained soils.
(3) Pen manuring in Tobago may supply all manurial needs of the cocoa.
(4) On black marl and calcareous and alluvial clay soils, superphosphate is the most valuable fertiliser.
(5) On many sandy loams, detritus and Northern Range schist soils potash may produce the best yield responses, but phosphates confer additional benefits when potash status is improved.
(6) Organic matter is essential and additions of it are often beneficial even when a litter of organic debris is already present.

88. Much remains to be learnt ; but, considering the baffling results in the past, much progress can be reported.

WITCHBROOM DISEASE OF COCOA.

89. Reference is made earlier to the work of Marper Estate which is run partly on commercial lines. Results at this station demonstrate that witchbroom on cocoa could be controlled ; provided reasonable market prices could be obtained for cocoa.

90. The main activities of the Department in relation to the disease have been along the lines of endeavouring to secure strains resistant to witchbroom. Following on his visit to Ecuador in 1937, Dr. Pound left for the valley of the Amazon and returned to Trinidad in May, 1938. He travelled up the Amazon and a number of its tributaries, examining cocoa in Brazil, Peru, Ecuador and Colombia, and discovered striking cases of groups of trees entirely free of witchbroom although their branches were interlocked with other trees that were heavily infected.

91. Planting material was collected and forwarded to Barbados for growth in quarantine, thanks to the courtesy of the Government and the Department of Agriculture in that Colony. It is very regrettable that the largest consignment of pods forwarded by Dr. Pound arrived during labour strikes on the water-front at Port-of-Spain and the seed lost its viability before it reached Barbados.

92. Active preparations have been made in Trinidad for testing the strains collected by Dr. Pound and 16 acres of land bounding on Marper Estate were purchased and prepared for this purpose.

93. Trials of progeny of local trees that have shown a measure of resistance have been continued. Of the 150,000 trees critically examined, only a few still give evidence of resistance to witchbroom.

ANIMAL DISEASES.

94. On the whole the incidence of disease in the colony has not been serious.

Paralytic Rabies.

95. Only two cases of paralytic rabies were reported in 1938 compared with 57 cases in 1937, 217 in 1936 and 331 in 1935. The position must therefore be considered to be very satisfactory, especially when it is borne in mind that it is estimated that over 2,000 deaths occurred in 1932. As usual, the demand for inoculation of animals fell off owing to the small number of cases.

96. The Health Department continued their campaign against bats and 1,693 Desmodus were destroyed of which 101 were found to be affected with the rabies virus, indicating, of course, that the disease is still a potential danger. The Government Bacteriologist, who has to his credit much valuable research work on the nature of this disease, continued his investigations during the year.

Tuberculosis.

97. Of 1,217 privately owned head of cattle tested in the neighbourhood of Port-of-Spain, four reacted and were destroyed ; and seven affected animals were destroyed at the Stock Farm.

Anthrax.

98. Two cases of anthrax were reported and dealt with under the Animal Diseases Ordinance.

DISTRICT AGRICULTURAL WORK.

99. The district work of the Department has been continued on the lines set out in previous reports. Mr. F. M. Bain, Agricultural Officer, was absent from June to December. Mr. B. G. Montserin, Agricultural Officer, was transferred to Tobago and placed in charge of the Department's work in that ward.

100. A general idea of the duties of the Agricultural Advisers may be obtained from a summary of the official visits made by one of the Agricultural Advisers during 1938 :—

Number of visits and mileage.

Head.	Sub-head.	Visits.		Reports.	P.P. Order.	Mileage.
1. Cocoa Subsidy ...	Inspections	123		122	...	2,087
	Advising in Field ...	77				
	Offices	36	236	...	...	...
2. Agricultural Bank ...	Relief (temporary) ...	2		...		
	Mortgages	24	26	20	...	380
3. Agricultural Societies ...	... ...		12	...	...	102
4. School Gardens ...	... ...		37	1	...	161
5. Plant Protection ...	Parasol Ants	6		...	2	
	Love Vine	87		...	19	
	Cane Mosaic	62	155	...	...	505
6. Special	Crown Lands inspection ...	3		3	...	
	Settlements	3		...	...	
	Valuations	38		5	...	
	Garden Competitions ...	65		3	...	
	Y.O.D.I.	28	137	...	...	588
7. Extraordinary ...	Fibre investigations ...	80		...	...	
	Poultry Show	3	83	...	...	352
8. Miscellaneous and General Advisory ...	... ...		290	...	...	1,640
	Total		976	154	21	5,815

Cocoa Small Holdings.

101. Under an agreement with the Cocoa Subsidy Board, the Agricultural Advisers, with the exception of two officers, devote three days a week to the inspection of cocoa holdings and their work in this connection is of particular value as it involves close and critical examination of the cultural methods adopted by individual proprietors. The results of these inspections bring to light the fact that, owing to low prices, many proprietors make every possible effort to secure other forms of occupation and consequently do not give to their properties the attention necessary for keeping them in good condition.

Land Settlements.

102. The description 'Land Settlement' may be misleading. In Trinidad at present, the term is applied, except in two cases, to blocks of land cut up into from ½ to 2-acre lots and leased or sold for the cultivation of food crops for home use and for sale for local consumption. The erection of houses on these lots is encouraged.

103. Examination of the 29 Settlements now in existence is on the whole disappointing, with the exception of two that combine export crops with food crops. A number of the owners or lessees of lots in the Settlement have erected houses, and to this extent at least the Settlements are an important contribution to the social development of a class that has a strong desire for the possession of home sites. The cultivation of food crops leaves much to be desired and experience shows that the majority of those who are eager to obtain land for the growth of food are primarily interested in drawing for two or three years on the natural fertility of the soil without maintaining its productivity by the addition of plant food and the adoption of cultural methods.

104. Two weaknesses, for which the settlers are not responsible, must be admitted: many of the settlements are on land of mediocre fertility and supervision has been inadequate.

105. In the early part of the year a Committee appointed by His Excellency the Governor to make recommendations regarding Land Settlements sent in their report. The Committee stressed the importance of the wide extension of allotments on which houses could be erected and food grown. With regard to the development of economic Land Settlements, the Committee pointed out that there were already a large number of small holdings in existence on which cocoa and sugar cane were grown.

106. Capital has already been put into these small holdings; many of them are on more fertile soil than is still available for alienation, and perennial crops are established. Development of these holdings on lines considered desirable for economic settlements appear sounder than plunging on a large scale into new economic settlements. Acceptance of such a principle would not, however, cut across the desirability of providing land for reliable applicants who do not already own land.

107. As an outcome of the recommendations of the Committee, the sum of $70,000 has been provided in the 1939 Estimates for the purchase of land and the creation of a special staff for supervision of Land Settlements.

Bananas.

108. The Banana Officer, Mr. J. E. J. Beausoleil, who is responsible for the selection of bananas at the Wharf, devoted much time endeavouring to develop the banana industry, but conditions are such that no confidence can be felt that an industry of any magnitude can be developed in the colony. Purchases have shrunk from 170,827 stems in 1937 to 131,728 for the current year.

109. There are four factors which stand in the way of progress. Much of the soil in the colony is not really well suited to the profitable growth of bananas. Secondly, Panama disease is prevalent. Thirdly, Cercospora disease is now widely distributed. Fourthly, rigid rejection of bunches insect spotted or vermin scratched is having a most discouraging effect on those interested in the growth of bananas for export. The first and second difficulties are the lesser: the third and fourth the major.

Home Grown Foods.

110. The bill for foodstuffs imported into the colony from abroad continues to be high although the total value in 1938 was £70,807 ($339,875) less than in 1937, due mainly to a fall in the value of flour from £433,788 ($2,082,185) in 1937 to £370,736 ($1,779,536) during the year under review. The value of importations of milk, rice and meat showed an increase.

111. The deterrents to the wider growth of food crops for family use and local consumption are:—

(1) The preference for certain kinds of food (*e.g.* flour, rice, condensed milk).

(2) The losses due to praedial larceny.

(3) The easy glutting of the local market for yams, sweet potatoes, &c.

112. This issue is one of major importance. Provided prices for the staple export crops do not materially improve a new orientation must be sought for the agriculture of the colony. Far more importance must be attached to the growth of food crops and the rearing of livestock.

Plant Protection Service.

Witchbroom.

113. Encouragement was given by Inspectors to the removal of witchbroom and records were kept of the general condition of the disease on estates receiving assistance under the Cocoa Subsidy Scheme. Special efforts were made to check development of this disease in the Toco area where it had recently appeared. Funds available to cocoa growers have not been sufficient for the adoption of adequate control measures, but, in addition, many cocoa proprietors do not pay sufficient attention to control measure.

Thrips.

114. Outbreaks of this pest occurred in October principally at Mundo Nuevo, Mamoral, Caparo, Guaico Tamana, Biche, Rio Claro, Plum Mitan, Manzanilla, Platanal and Toco. Severe defoliation resulted in December.

Cocoa Beetles.

115. This pest has died down considerably, the only places of slight activity are in the hurricane area in the southern districts of the island.

Cocoa Rats.

116. Free distribution of "sulphur matches" to cocoa proprietors was discontinued during the year, but matches were issued at cost price to all applicants. The demand, however, was small and there were signs of the recurrence of injury from cocoa rats in certain districts.

Squirrels.

117. Squirrels continue to be a major pest of cocoa and on one property at Sangre Grande where a small picking was made about 50 per cent. of the pods were destroyed by this pest. Experimental trial of poison baits are in course of progress.

Black Bees.

118. Not many complaints were received; 8 Plant Protection Orders were served and 20 nests destroyed.

Parasol Ants.

119. Four hundred and six nests were destroyed. Of this total, 148 nests were destroyed by the district staff with the new insecticide, "Cyanogas", which proved to be very effective. Seventy Plant Protection Orders were served.

Panama Disease.

120. Panama disease of bananas is still on the increase and very little attention is given to control. Supplies of B.D.K. oil are still available, free of charge, to all planters having up to 50 acres of land. Only 242 stools of Gros Michel banana were treated during the year.

Leaf Spot Disease.

121. This disease has increased rapidly all over the island; Toco, the only district which was not affected during the previous year is now suffering from it. Practically no control work is being carried out. The heaviest affected districts are Guapo, Siparia, Erin, Moruga, Rio Claro, Biche, Caparo, Manzanilla, Sangre Grande and Guaico Tamana.

Scab Disease on Grapefruit.

122. Scab disease on grapefruit which up to the early part of the year was only found in the Santa Cruz and Maraval valleys, has been discovered in various parts of the island, but in a mild form.

123. During the later part of the year a survey was made on every grapefruit plantation in the island and 23 were found affected.

124. The affected properties were found in the following districts:—

Santa Cruz	7	Diego Martin	2
Caroni	1	Cunupia	2
Chaguanas	1	Williamsville	1
San Rafael	1	Erin	1
Arima	4	Cumuto	1
Sangre Grande	2		

125. Below is a summary of the survey:—

No. of Properties.	*Acres.*	*Total No. of Trees.*	*Properties affected.*	*Acres.*	*No. of affected Trees.*
232	3,154¼	209,752	23	563½	3,176

126. The heaviest affected district is Santa Cruz and on one property there, about 300 trees were topped and budded with the Valencia orange. On a property at Sangre Grande on which 9 affected trees were found, the affected branches were removed and all the trees in the field were sprayed with "Perenox". No more diseased tissues have been observed since.

127. Spraying experiments at Santa Cruz gave encouraging results:—

	Sprayed.	*Unsprayed.*
Clean Fruit	85	37
Scabbed Fruit	11	70

Sugar Cane Mosaic.

128. Routine inspections were continued during the year and 1,868 affected stools destroyed on 458 properties belonging mostly to cane farmers.

129. This disease has never assumed alarming proportions in Trinidad. The different kinds of mosaic on cane and maize and the vectors in the colony needs elucidation.

Agricultural Credit and Co-operative Societies.

Credit Societies.

130. Two new societies were registered during the year, the number in operation being 54 of which there are 41 in Trinidad and 13 in Tobago. Of the 41 societies in Trinidad, 21 are under the control of the Department of Agriculture and 20 are associated with and supervised by the Ste. Madeleine Sugar Company, Ltd.

Trinidad.

131. The 21 societies run by the Department consist of 671 members. New loans amounting to $16,878 were granted to 15 societies, and the total indebtedness to Government at the close of the financial year, 30th June, 1938, was $24,004.03 of which $10,218.24 was repaid leaving a balance of $13,785.79. Owing to weather conditions which seriously affected some of the societies, they have not been able to meet their obligations as promptly as in the past.

Ste. Madeleine.

132. The 20 Ste. Madeleine societies consist of 785 members of which 641 received advances amounting to $44,467. The sum of $41,836.42 has been repaid leaving a balance of $2,630.58. The deplorable weather conditions which prevailed during the last crop militated against the societies liabilities to the Company being settled in full.

Tobago.

133. No new loans were made to the Tobago credit societies, efforts being chiefly concentrated in the collection of outstanding balances long overdue. On the 1st of July, 1937, 10 societies owed Government a balance of $4,021.90 and the interest to 30th June, 1938, amounted to $203.43 making a total of $4,225.53. The sum of $1,094.20 which includes an overpayment by one society of $8.56, was repaid leaving a balance of $3,139.19 still owing by nine societies at the 30th June, 1938. The other four societies have settled all their liabilities. The membership of the Tobago credit societies has dwindled to 242 which will automatically increase when new loans are granted to the societies.

Co-operative Societies.

Tobago Producers' Co-operative Association, Ltd.

134. An investigation into the working of the Association and its financial position was made early in the year. The position was found to be very unsatisfactory. The management of the Association was placed in the hands of the Hon. Geo. de Nobriga and fair progress has been made in the reconstruction of its business.

Tobago Lime Growers' Co-operative Association, Ltd.

135. The quantity of limes handled at the factory amounted to 9,722 barrels as compared with 8,567 barrels for the preceding season. The lime oil produced by the factory is sold through the Lime Oil Producers' Association of Trinidad and Tobago. Due to a slump in market price of lime oil an embarrassing financial position had to be faced during the year and the assistance of Government was solicited. An additional loan was granted to the Association for the installation of modern mills for the purpose of effecting a higher percentage extraction of oil. Also, a minimum price per pound of oil was guaranteed any loss to Government to be repaid later.

Tobago Co-operative Cocoa Fermentaries.

136. The five co-operative cocoa fermentaries in Tobago continued operations during the year, the total amount of cocoa handled being 2,477 fanegas as against 1,567 fanegas for the preceding season. Roxborough and Pembroke fermentaries have done exceedingly well, the former having increased its production from 705 fanegas in 1937 to 1,282 fanegas in 1938 and the latter 358 fanegas in 1937 to 592 fanegas in 1938. Delaford has improved slightly but the other two fermentaries—Scarborough and Parlatuvier—are not making satisfactory progress.

Co-operative Citrus Growers' Association, Ltd.

137. There was a marked expansion in the operations of this Association which handles the whole of the export citrus crop, the shipments during the year being 79,660 cases of grapefruit and 24,650 cases of oranges compared with 45,572 cases of grapefruit and 20,000 cases of oranges in 1937.

138. Extensions to buildings and machinery are essential for handling future crops.

Coconut Growers' Association, Ltd.

139. This Association has entered upon its third year of operation and during the year handled 3 million nuts and 3,923 tons of copra as against 2½ million nuts and 5,338 tons of copra in the preceding season. Apart from the manufacture of edible oil and lard the Association has included the curing of tonka beans among its operations.

Government Fermentaries.

140. The Biche fermentary handled 220,186 lb. of wet cocoa yielding 84,336 lb. dry, or 766·7 fanegas, during the crop season ending 30th June, 1938, as compared with 111,248 lb. wet cocoa yielding 41,552 lb. dry or 377·8 fanegas for the preceding season. In all 155 small holders and contractors delivered cocoa to this fermentary during the 1937-38 season as against 130 for the previous season.

141. The Penal fermentary handled 76,974 lb. wet cocoa yielding 28,661 lb. dry or 260·5 fanegas for the 1937-38 season as compared with 32,757 lb. wet cocoa yielding 12,210 lb. dry or 111 fanegas for the preceding season. Forty peasants delivered cocoa during the 1937-38 season as against 22 in the previous season.

142. The cocoa from both fermentaries was marketed through the Cocoa Planters' Association, thus enabling the small producers to obtain advantageous plantation prices for their cocoa.

COMMITTEE WORK.

143. The Director and the Deputy Director have to devote much time to Committee work and one or other of these officers is member, or Chairman, of the following Committees: Board of Agriculture; Committee of Management of the Agricultural Society and the Livestock, Cocoa and Exhibition Sub-Committees of the Society; Agricultural Bank; Cocoa Subsidy Board; Hurricane Relief and Cocoa Industry Relief Committees; Sugar Cane Investigation Committee; Banana Board; Plant Quarantine Committee; Board of Management of the Ground Provision Depot; Land Advisory Committee; Nutrition Committee; Board of Management of the Co-operative Citrus Growers' Association; Land Settlement Committee; Civil Service Staff Board; Oil and Water Board; Tourist and Exhibitions Board; Crown Traces Committee; and Arbitration Board under the Cane Farming Control Ordinance.

IMPERIAL COLLEGE OF TROPICAL AGRICULTURE.

144. It is a pleasure to acknowledge the indebtedness of the officers of the Department of Agriculture to the Principal and members of the staff of the Imperial College of Tropical Agriculture for ready assistance in various matters relating to the agricultural problems of the Colony.

DEPARTMENTAL PUBLICATIONS AND CONTRIBUTIONS TO TROPICAL AGRICULTURE.

"History and Cultivation of the Tonka Bean (*Dipteryx odorata*) with Analyses of Trinidad, Venezuelan and Brazilian samples" (*Tropical Agriculture*, Vol. XV, No. 1, pp. 4-9, Vol. XV, No. 2, pp. 28-32)—F. J. Pound, PH.D., B.SC.

"A progress Report on a Large Scale Manurial Experiment on Marsh Grapefruit"—E. J. Gregory, DIP. AGRIC. (Wye), A.I.C.T.A.

"Cacao and Witchbroom Disease (*Marasmius perniciosus*) of South America."—Report by F. J. Pound, PH.D., B.SC.

"The need for Livestock Improvement in Trinidad."—J. L. Shannon, D.V.M.

"Field Experiments on Sugar Cane in Trinidad." Annual Report for 1938.—P. E. Turner, M.SC., F.I.C.

"A Preliminary Survey of Soil Types of Sugar Estates of Trinidad" with special reference to the allocation of Sugar Cane varieties.—P. E. Turner, M.SC., F.I.C. and C. F. Charter.

"List of Cultural, Manurial and Varietal Experiments on Sugar Cane in operation in Trinidad, 1938."—P. E. Turner, M.SC., F.I.C.

"Entomological Contributions to the Study of the Sugar Cane Froghopper. III. Observations on the Biology of certain Neotropical species of Tomaspis." (*Tropical Agriculture*, Vol. XV, No. 3, pp. 56-65)—A. Pickles, M.SC., F.R.E.S., A.I.C.T.A.

"A note on Pyrethrum as a possible Insecticide for the control of the Sugar Cane Froghopper." (*Loc. cit.* No. 4, pp. 75-76).—A. Pickles, M.SC., F.R.E.S., A.I.C.T.A.

"Insecticides for the Control of Certain Trinidad Crop Pests." (*Loc. cit.* No. 6, pp. 126-131).—A. Pickles, M.SC., F.R.E.S., A.I.C.T.A.

"Manurial Experiments on Cocoa in Trinidad."—F. J. Pound, PH.D., B.SC.

AGRICULTURAL AND VETERINARY LEGISLATION.

145. The following Ordinances, Proclamations and Regulations affecting agriculture and veterinary came into force during the year :—

Ordinances.

No. 8—The Agricultural Co-operative Societies (Amendment) Ordinance, 1938.
No. 9—The Plant (Export Prohibition) Ordinance, 1938.
No. 12—The Carts Ordinance, 1938.
No. 13—The Crown Lands (Amendment) Ordinance, 1938.
No. 14—The Diseases of Animals (Amendment) Ordinance, 1938.
No. 18—The Copra Products (Control) (Amendment) Ordinance, 1938.
No. 24—The Botanic Gardens Ordinance, 1938.
No. 32—The Land Acquisition (Amendment) Ordinance, 1938.
No. 36—The Cane Farming Control Ordinance, 1938.

Proclamations.

Nos. 13 and 35—These Proclamations were issued under Section 5 of the Plant Protection Ordinance, Cap. 138 in regard to certain articles that may or may not be imported into the colony.

No. 31—Issued under Section 5 of the Plant (Export Prohibition) Ordinance, No. 9 of 1938, prohibiting the exportation of I.C.2 banana planting material except under permit obtained from the Director of Agriculture.

No. 36—Issued under Section 2 of the Plant Protection Ordinance, Cap. 138, declaring any disease to be a notifiable disease and any pest to be a notifiable pest within the meaning of the said Ordinance.

Regulations.

The Diseases of Animals (Payment of Fees) Regulations, 1937.
(Made by the Governor in Executive Council, 4th January, 1938.)

III—REVENUE AND EXPENDITURE.

146. Annexure "A" contains a detailed statement of the accounts of the Department for the year 1938. The total expenditure amounted to £62,663 14s. 3d. and was £11,756 15s. 9d. more than in the previous year. The total revenue was £15,955 2s. 6½d. and was £1,632 18s. 8½d. less than in 1937. The Stock Farm brought in £7,223 7s. 3d. ; River Estate £3,371 6s. 5½d. ; the St. Augustine Nursery and Experimental Station £2,283 15s. 9d. and Veterinary Fees £1,922 18s.

147. The work under the Plant Protection Ordinance was responsible for the sum of £5,920 9s. 10d. Upkeep of the Royal Botanic Gardens, the Queen's Park Savannah and other Government Grounds cost £4,124 9s. 1½d. ; and £310 was a contribution to the work of the Sugar Cane Investigation Committee.

IV.—STAFF.

Appointments and Transfers.

148. Mr. A. B. Killick, Deputy Director of Agriculture, was transferred on promotion to the post of Deputy Director of Agriculture, Tanganyika and sailed on the 1st December. The Department regrets the loss of an efficient and able officer.

149. Mr. E. J. Gregory, Manager, St. Augustine Experiment Station, accepted the post of Agricultural Officer, Uganda Protectorate, and left the colony on the 25th April.

150. Mr. V. I. Mulloon was appointed an Agricultural Adviser as from 1st July.

151. Mrs. C. Acham Chen was appointed a 3rd Class Clerk as from the 21st February and Mr. O. Rampersad, 3rd Class Clerk at the Head Office transferred to the Government Farm with effect from the same date. Early in November, Mr. P. Castagne, 3rd Class Clerk at the Head Office was transferred to the Customs Department and was replaced by Mr. J. D. Arneaud who took up duties on 19th November.

Leave.

152. The following officers of the Department were on leave for three months or over during the year:—Dr. F. J. Pound, Agronomist; Mr. F. Stell, Plant Pathologist; Mr. V. O. Ferrer, Agricultural Adviser; Mr. M. Dhein, Chief Clerk; and Mr. A. Rahman, Laboratory Assistant to the Plant Pathologist.

153. Mr. F. M. Bain, Agricultural Officer, who was granted a scholarship by the Carnegie Corporation, left the colony on the 8th July for a nine months' course at the California University for the purpose of studying the principles of orchard management as related to citrus.

Retirement.

154. Mr. R. S. Hanomansingh, Agricultural Adviser, who went on leave in August, 1937, tendered his resignation in June and his duties are being carried out by Mr. I. Hosein who was appointed to act as an Agricultural Adviser on the 26th July, 1937.

155. Mr. A. O. Harris who held an acting appointment as Agricultural Adviser, Nariva-Mayaro, left the service on 31st May.

156. After a period of over 10 years faithful service, Miss C. M. Seheult, Herbarium Assistant, resigned from the Government Service as from the 30th November.

Acknowledgments.

157. The Department during the year has been short staffed owing to the transfer on promotion of the Deputy Director and Mr. Gregory, the absence for a part of the year of the Mycologist, the Agronomist and Mr. F. M. Bain, Agricultural Officer, and I desire to acknowledge my indebtedness to all those officers who have willingly and cheerfully undertaken more than their usual share of work.

E. J. WORTLEY,
Director of Agriculture.

15th May, 1939.

PART II.

DIVISIONAL REPORTS.

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REPORT OF THE AGRONOMIST FOR 1938.

The report for 1938 is covered by the following heads :—

A.—Introductory Note.
B.—River Estate.
C.—Marper Estate.
D.—Fertiliser Experiments on Cocoa.
E.—Fertiliser Experiments on Other Crops (Tonka Beans ; Coconuts).
F.—Search for Witchbroom Resistant Strains of Cocoa.
G.—Miscellaneous :
Budded Cocoa.
High Yielding Tonka Beans.
Salt Water Paddy.
Fibre Industry.

A.—Introductory Note.

2. More than nine months of 1938 were spent away from Trinidad ; in the early part of the year conducting an expedition through the Amazon Valley and Colombia in search of strains of cocoa which might prove resistant to witchbroom.

3. Hence the present report covers little more than the routine work which was ably carried out by the staffs of the two Government Estates and two assistants.

4. Under the head " G.—Miscellaneous ", notes on the budding of selected high yielding self compatible cocoa trees for several trial plots are given. During 1939 provision has been made for an expansion of the output of budded cocoa plants since it is realised that the only real rehabilitation of the Cocoa Industry will be brought about by increased yields.

5. Provision has also been made in 1939 for the initiation of a series of fertiliser and cultural trials on vegetables, the growing of which is relegated to a few industrious people who make large profits when fair yields are obtained. The local price of home grown foodstuffs is absurdly high as evidenced by the market price of cabbages at 9d. each and cauliflowers at 2/- each.

B.—River Estate.

6. In the report for 1937 it was mentioned that River Estate was undergoing a process of reorganisation and re-allocation of areas. This work has now practically been completed and fields, which formerly were pure stands of cocoa, but in which the costs of production were high, have been interplanted with alternative crops. Where coffee and tonka beans have been planted in between the old cocoa trees, the cocoa trees are now being reduced. Much of the coffee planted in poor fields at the end of 1935 and during 1936 is now bearing, and at the same time it is covering in the open spaces between the cocoa trees to the advantage of the cocoa.

Results of Experiments on Cocoa.

(1) *Replacement of Poor Bearers in Field 2.*

7. This experiment was commenced in 1913 when natural yields were taken for each tree in the field during the period 1913-1919. At the end of that period all the trees which were yielding less than a stated amount of cocoa were replaced by budded or seedling progeny from heavy bearers. During the natural record period some old and poor trees were replaced. During the period from 1913 to 1919, 48 per cent. of the pickets, which, of course, included non-bearing supplies, were producing 16 lb. per acre or 4 per cent. of the crop. The subsequent yields are summarised in the table below.

Yields lb. Dry Cacao per Acre.

	1913-19.	1919-24.	1924-29.	1929-34.	1934-38.
New pickets	16	11	73	195	249
Original pickets	410	404	449	368	312
Total yield per acre	426	415	522	563	561
Percentage of crop by new pickets	4%	2¾%	15%	35%	44%

8. Five to ten years after 1919, the new trees were responsible for 15 per cent. of the crop ; ten to fifteen years later they were responsible for 44 per cent. of the crop, *i.e.* pulling their weight in the field. The yield of the field has increased by 33 per cent. It will be noted that the general trend of yields, as shown by the original pickets, was to decrease. The yields of a neighbouring field, selected for comparative purposes, show this tendency to decline, which we now know is due to deficiency of potash and humus in the soil.

1914-19.	1919-24.	1924-29.	1929-34.	1934-38.
380	389	317	264	285

Allowing for this declining trend, the crop in Field 2 in 1934-38 would have been 324 lb. The actual crop was 561 lb. The new pickets have increased the ' expected ' crop by 76 per cent. This experiment is described in some detail owing to its bearing on the important question of increasing crop yields.

(2). *Distance Spacing Experiments.*

9. In this field 7 acres were planted as a trial to determine the most economical spacing for cocoa trees on this soil type.

10. Unfortunately the spacings 12×12 feet, 14×14 feet, 16×16 feet and 18×18 feet, each one acre in extent were planted 8 years before the 6×6 feet, 8×8 feet and 10×10 feet, spacings so that direct comparisons cannot be made by eye. The yields given in the table below are the average of the first 13 crops for all blocks and the 13th crop of each spacing is given for comparison (all figures are in lb. of cured beans per acre).

Spacing Experiments.

Distance.	Average 1st 13 crops.	Yield 13th Crop.	
		1938.	1930.
6×6	390	581	
8×8	367	577	
10×10*	219	485	
12×12	393		566
14×14	381		611
16×16	319		569
18×18	286		488

*This plot happened to strike a poor pocket of soil and yields are lower than would be expected on that account.

11. The important conclusion can be drawn that as far as yields are concerned it makes little difference what distance apart the cocoa trees are planted.

12. It does, however, make a great difference to the cost of establishment and upkeep of the plots. It is estimated that the 6×6 feet plot cost about one half that of the 18×18 feet, plot in bringing the cocoa trees to the age of 15 years. Naturally the yield per tree in the 6×6 feet plot is only on the average one-ninth that of the 18×18 feet plot but then one casualty amounts to only one-ninth of the loss. The closer spacings were planted without shade and have formed their own canopy which needs little pruning.

13. The average of the first 21 crops of the wider spacings shows that the 16×16 feet and 18×18 feet blocks still lag behind the 12×12 feet and 14×14 feet blocks but in the 21st crop the reverse is the case.

Wider Spacings.

Spacing.	Average yield 21 crops.	Yield 21st Crop.
12×12	461 lb. per acre	521 lb. per acre.
14×14	472 do.	490 do.
16×16	430 do.	644 do.
18×18	416 do.	664 do.

3. *Pruning Experiment in Field 9c.*

14. The object of this experiment is to rejuvenate old cocoa trees by careful pruning and to bring them back into a reasonable shape. Each row represents one treatment. Treatments are :

A.—Pruning —May 1935 and 1936 —
B.— —June do. —
C.— —July do. — } Replicated eleven times.
D.— —August do. —
E.—River Estate for Control —

Yields in lb. dry Cocoa per 300 Bearing Trees.

	1935-36.	1936-37.	1937-38.
A. Pruning —May	513	713	1106
B. do. June	356	632	1018
C. do. July	338	706	1062
D. do. August	340	475	996
E. Control	74	1062	1223

15. It will be noticed from the table above how the control rows took advantage of the removal of competition and forged ahead in yields but the rejuvenated trees are following close on their heels.

16. The whole experiment has been given standard fertiliser together with an initial dressing of 300 lb. sulphate of Ammonia per acre to encourage new vegetative growth after the pruning.

4. *Demonstration experiment in Field* 10.

17. Eight blocks of cocoa were taken in Field 10 for this experiment. Each block consisted of four rows of approximately 30 trees and covered two-fifths acre.

Four treatments were replicated twice.

They were :

1. Control.
2. Deep draining and roundridging.
3. Deep draining and roundridging over 20 tons of mulch per acre.
4. Deep draining, roundridging over 20 tons of mulch per acre and dressing of 600 lb. sulphate of potash and 600 lb. superphosphate per acre.

While the experiment was being laid down the plots were rehabilitated, consequently the number of bearing trees varied from 68 to 112 per 120 pickets. The experiment commenced in 1937 and to date there are records of the first crop. These are given in the table below expressed both as pounds of dry cocoa per acre on the area of land and also as pounds per 300 bearing trees.

Treatment.	lb. per acre on area.	lb. per 300 bearing trees.
Control	321	614
Drain and roundridge	425	577
Drain roundridging and Mulch...	470	691
Drain and Roundridge Mulch+fertiliser ...	686	1,072

18. A consideration of these results suggests that the operation of draining and roundridging alone has not been beneficial but mulch or mulch plus fertilisers incorporated at the same time have proved exceedingly beneficial. By far the greatest individual benefit is that accruing from the application of fertilisers. The cocoa obtained was not, of course, sufficient to pay off the capital expenditure of the treatments in the first crop.

5. *Cocoa Rehabilitation Work.*

19. This is an area where the policy of removing poor bearers and otherwise dud trees was recommenced in 1936. Although some 20 per cent. of trees were removed in 1936 and replaced with supplies, the yields of the fields have not suffered.

20. Fields 13A and 13B were given standard fertiliser treatment for two consecutive years (1936 and 1937). Note in the yield table below how the yields have risen above the 1934-35 levels by 1938 and have outstripped Field 12 in recovery.

21. The capital cost of the rehabilitation work is set out below :

	Per annum.
1st year (1936) :	$ c.
Cost of topping and pruning trees	3 35
Cost of removing dud trees and preparing holes	2 35
Cost of planting supplies and mulching	1 76
Cost of planting ground shade	1 72
	9 18
Fertiliser	21 00
Total	$30 18
2nd year (1937) :	
Cost of removing additional dud trees	50
Cost of planting additional cocoa trees	18
Manuring and Mulching	2 17
	2 85
Fertiliser	21 00
TOTAL	$23 85

The crops in these fields for the last five years are given below in bags per acre :

	Before Rehabilitation.			After Rehabilitation.	
	1934.	**1935.**	**1936.**	**1937.**	**1938.**
Field 12	1.7	1.9	1.4	1.6	2.9
Do. 13A	3.9	3.5	2.8	3.1	5.3
Do. 13B	4.8	3.9	3.2	4.3	6.0
Do. 16	3.8	3.8	2.5	3.2	4.0

The old cocoa trees were in many cases twice as high as they are now.

6. *Propagation Experiments in Field* 25.

22. This field is devoted largely to experiments on budded cacao. In the main section there is a trial of propagation methods, with and without shade. The yields here show very little difference such differences as do occur may be due to variations in soil fertility.

23. The trial of red *v.* yellow pod types has been continued on account of the high yields given by two of the clones. The yield data is given below :

FIELD 25 (WEST) : A. PROPAGATION EXPERIMENTS : PLOTS OF 287 TREES : 6 ACRES—AVERAGE FOR 21 CROPS

1. *With Immortel Shade.*

Bags per acre 1938.		1918-38.	1934.	1935.	1936.	1937.	1938.
5.5	(*a*) Budded at Stake	504	567	972	747	878	915
4.8	(*b*) Budded in Nursery	454	536	833	645	859	793
4.4	(*c*) Seedlings at Stake	466	426	710	612	739	724
4.9	(*d*) Grafted	468	519	866	629	819	815
	2. *Without Immortel Shade.*						
3.9	(*e*) Budded at Stake	422	496	835	538	763	652
4.3	(*f*) Seedlings at Stake	469	577	991	700	873	716

Trenched with pen manure in 1934. The fertiliser experiment over this experiment is described later

FIELD 25 (EAST): B. BUDDED COCOA GROWN WITHOUT SHADE, PLANTED 1922. NINE PLOTS EACH OF 1/6TH ACRE (APPROX.).

Plots.	*Yield lb. dry Cacao Average* 1931-38.
1. Seedlings from tree bearing yellow pods	764
8 do. do. light red pods	508
9 do. do. dark red pods	698
2 single bud from tree bearing yellow pods	932
4 do. do. light red pods	612
3 do. do. dark red pods	1,192
5 One ' yellow ' and one ' red' bud on same stock	819
6 One ' yellow ' and one ' red ' budded plant at same picket	659
7 One ' yellow ' and one ' red ' seedling at same picket	569

This experiment shows that for the particular parent used :

(1) The budded plants are better progeny than seedlings.

(2) The ' red ' parent gives progeny which are more vigorous and better yielding than the ' yellow ' whether competing on the same stock or at the same picket.

24. The dark red clone is self compatible and the results must not be considered to hold for all red and yellow types. The result of greatest value is the yield which small self-compatible budded trees can produce, *i.e.* a yield of 1,192 lb. per acre from plot 3 as an average for 7 years.

Average 1931-38—1,192 lb. per acre ... ... =24.1 bags per 1,000.
Average for Trinidad ... ... =200 lb. per acre or =4 bags per 1,000.

7. *Trenching in Field* 3A.

25. This experiment compares trenching with debris, against trenching with debris and added pen manure at the rate of 16-20 tons per acre. There was no real control plot set aside to show the value of the trenching with debris but the yields of the neighbouring field (4) which was untreated, serve for comparison.

YIELD IN LB. PER ACRE.

YEAR.	1932.	1933.	1934.	1935.	1936.	1937.	1938.	Average 6 years 1933-38.
Control Field 4A	—	346	346	446	463	260	260	354
Debris alone	409	394	384	542	354	329	338	390
Debris+P.M.	475	678	578	682	476	479	446	557
Diff. due to debris	—	48	38	96	—109	69	78	36
Additional Val. of P.M. ...	66	284	194	140	122	150	108	167

Over the six year period the pen manure has been responsible for an average increase of 1 bag per acre which not only paid the cost of the pen manure but also the cost of trenching it with debris.

FERTILISER EXPERIMENTS ON RIVER ESTATE.

A Comparison of Nitrogen, Potash and Phosphate Fertilisers under partial shade conditions.

26. This is a 4×4 latin square experiment which has main plot treatments arranged to compare the relative values of potash and nitrogen, and a half plot treatment to assess the value of phosphate. Details of the layout have been published in earlier reports and will not be rep ated here.

27. Before fertilisers were applied the yield records, as pods, were taken for two years. These records served as a basis for examining the subsequent yields.

28. Fertilisers were applied for three consecutive years, at the rate of 600 lb. per acre per annum for potash and phosphate and 1,200 lb. per acre for the first two years for sulphate of ammonia,after which only 600 lb. per acre was applied for the third year.

29. For the last two years no fertilisers have been applied but records have been taken to assess residual effects.

30. For individual yields of previous years the reader is referred to earlier reports. In the present report a summary only is given in terms of lb. dry cocoa per acre.

Treatment.	Average 2 years natural yields.	3 years expt.		Gain.	2 years residual.		Gain.	Gain due to fert.
		Expect.	Actual.		Expect.	Act.		
								lb.
Potash+nitrogen ...	734	708	828	120	532	753	221	802
Potash	738	712	968	256	534	806	272	1312
Nitrogen	681	657	549	−108	493	391	−102	loss.
Control	631	609	609	—	475	475	—	—

The Half-Plot Phosphate Effect.

Treatment.	Average 2 years natural yields.	Average 3 years experiment yields.	Average 2 years Residual.	Total experiment.
With phosphate	669	753	570	1323
Without phosphate	723	724	643	1367

31. It cannot be claimed that phosphate on this site has been more than of slight benefit. Nitrogen has reduced expected yields by an average of nearly one fanega per acre and it has also had the same effect on the increase due to potash.

32. The only beneficial treatment is potash.

33. The balance sheet to date for potash is given below.

Gain due to fertiliser.	Value at 5c. lb.	Cost of fertiliser.	Profit.
1312 lb.	$65.60	$45.00	$20.00

which means a profit of $4.12 per acre per annum. The final profit may be even greater for there are still residual effects to be worked out.

The Relative Values of Nitrogen, Potash and Phosphate with unshaded and partial shaded cocoa. Code Nos. A11 and A12.

34. The two experiments about to be described are identical 5×5 latin square trials with half plot potash treatments, except that one is conducted on cocoa grown without the usual leguminous shade trees while the other is conducted on partially shaded cocoa. The word 'partial' here refers to a shade tree density of 40 shade trees per acre which is about 2/3 that originally planted.

35. Natural yields were taken in each case for one year prior to the application of fertilisers.

36. Fertilisers were first applied in 1934; the following treatments were given:
A.—600 lb. sulphate of ammonia + 600 lb. superphosphate + 450 lb. sulphate of potash per acre.
B.—600 lb. superphosphate per acre.
C.—600 lb. sulphate of ammonia per acre.
D.—600 lb. sulphate of ammonia + 600 lb. superphosphate per acre.
E.—Control.

37. The half-plot sulphate of potash treatment was at the rate of 450 lb. per acre. Fertilisers have now been applied for four consecutive years.

38. The results obtained for the unshaded experiment will be considered first. They are expressed below in terms of lb. dry cocoa per acre.

Treatment.	Natural yield.	1st expt. year 1934-35.	2nd expt. year 1935-36.	3rd expt. year 1936-37.	4th expt. year 1937-38.
Control	539	827	869	1033	647
Nitrogen (N)	519	1029	968	1029	695
Phosphate (P)	385	733	768	788	543
Potash (K)	486	1032	893	1082	942
N.P.	480	819	808	759	458
N.K.	440	1054	1026	1096	844
P.K.	438	1045	1021	1021	997
N.P.K.	495	1060	1019	1148	965
N.P.2K	510	1317	1221	1300	1228

39. The apparent increase of yield as a result of application of sulphate of ammonia is not statistically significant. Superphosphate alone has not been beneficial but the increase due to the application of sulphate of potash is quite significant.

40. The combination sulphate of ammonia and superphosphate tends to depress rather than increase yields. Neither is sulphate of ammonia of any benefit to potash although superphosphate does appear to supplement the value of potash to some extent.

41. When both sulphate of ammonia and phosphate are added with potash the yield is less than when phosphate alone is added but greater than the yield from sulphate of ammonia plus potash.

42. The effect of doubling the dose of potash on this site is astounding.

43. There is no doubt that only potash compounds are worth applying to this site, the phosphate and nitrogen applications, if not harmful are merely wasted.

44. The experiment laid down on cocoa growing under partial shade conditions gives, on the whole, similar results but with some important modifications.

45. The results expressed as lb. of dry cocoa per acre are given below.

Treatment.	Natural yield.	1st Expt. year 1934-35.	2nd Expt. year 1935-36.	3rd Expt. year 1936-37.	4th Expt. year 1937-38.
Control	469	960	779	786	664
Nitrogen (N)	442	1036	746	765	719
Phosphate (P)	429	1102	836	904	816
Potash (K)	286	1111	873	834	818
N.P.	359	1224	1034	942	768
N.K.	367	1166	891	939	886
P.K.	396	1355	1023	1162	1074
N.P.K.	449	1395	1019	1023	968
N.P. 2K	444	1590	1113	1104	1004

46. Although sulphate of ammonia does not actually depress yields it is a gain of no benefit to the cocoa. Superphosphate, however, is slightly beneficial and although not profitable by itself gives greater assistance to sulphate of potash than in the "no shade" experiment.

47. In this experiment, nitrogen depresses the benefits of potash and phosphate more than in the "no shade" block.

48. For purposes of a clearer comparison the average yields of each treatment for the four experiment years have in each case been expressed as the arithmetical increase over the natural yields and ranged alongside one another in the table below :

Average Yields as Increase over Natural Yields.

Treatment.	No shade.	Partial shade.
Control	305	328
Nitrogen (N)	411	374
Phosphate (P)	323	486
Potash (K)	501	623
N.P.	231	633
N.K.	565	604
P.K.	583	758
N.P.K.	553	652
N.P. 2K	757	759

49. It will be noticed that the average increase in the case of the control plots was approximately the same for both experiments. Potash was very beneficial under both conditions. Sulphate of ammonia appeared to have a greater depressing effect on potash and phosphate in the "no shade" block.

50. In the unshaded block the average increase of plots which received no potash was 318 lb. per acre, those which received 450 lb. potash increased by 551 lb. per acre while the 900 lb. per acre application gave an average increase of 757 lb. per acre making a smooth increment increase of over 200 lb. per acre for an application of 450 lb.

51. The benefit from phosphate under partial shade conditions obscures the comparison of increases due to unit applications of potash in that block.

Comparison of different methods of N.P.K. fertilising—Code No. A.14.

52. This another 5×5 latin square experiment in which nitrogen was applied in the form of sulphate of ammonia or nicifos C, phosphate as superphosphate or nicifos C and potash as sulphate or muriate.

53. The potash comparison was made by giving sulphate to one-half of each plot and muriate to the other since it has been well proved that potash is the factor limiting yields on this soil.

54. No natural yields were taken over the experiment block prior to the application of fertilisers but for three years before the experiment the whole block yielded an average of 10.23 bags per 1,000 pickets = 507 lb. per acre.

55. The treatments were :

A. 792 lb. superphosphate per acre.

B. Control.

C. 339 lb. ammonium sulphate per acre.

D. 450 lb. nicifos C per acre.

E. Superphosphate (A) plus ammonium sulphate (C).

½ plot sulphate of potash 600 lb. per acre.

½ plot muriate of potash 600 lb. per acre.

56. The yields in lb. of dry cocoa per acre are given for the three experiment years in the table below :

Treatment.		Yield in lb. dry cacao per acre.			Total.	Per cent. increase over control.
		1935-36.	1936-37.	1937-38.		
Super	S	1067 } 1100	1115 } 1131	1098 } 1191	3423	20.3
	M	1133	1148	1284		
Nicifos	S	979 } 959	1010 } 1072	1115 } 1130	3161	11.1
	M	939	1133	1144		
Ammonia	S	898 } 916	880 } 930	922 } 944	2790	Loss.
	M	933	981	966		
Super+Ammonia... ...	S	878 } 820	1010 } 906	988 } 977	2703	Loss.
	M	761	801	966		
Control	S	889 } 894	948 } 932	1010 } 1020	2846	—
	M	898	915	1030		
Average	S	942	993	1027	—	—
	M	993	996	1078	—	—

57. This experiment has now given a number of exceedingly valuable results. Of foremost value is the basic effect of potash which has almost doubled the natural yields for the three years of the experiment.

58. Superphosphate has aided the effect of potash by giving an additional 20 per cent. increase, while nicifos C with the same quantity of phosphate has only given 11 per cent. increase. Considered in the light of previous experiments, it would appear that the nitrogen in nicifos is definitely harmful and is preventing the phosphate from exerting its full effect. This is brought out again in the other treatments where sulphate of ammonia has actually reduced yields compared with the control plot ; and mixed with superphosphate has succeeded in depressing yields still further on this site.

59. As for the relative benefits of sulphate and muriate of potash it appears that the slight difference is in favour of the cheaper muriate, although this difference is not statistically significant. Certainly the muriate has not yet shown up the ill effects forecasted for it.

Optimum Quantities of Potash on Sandy loam soils—Code Nos. A8, A9, *and* A10.

60. The experiments described above give comparisons of the values of nitrogen, potash and phosphates. Of the three, there is little doubt that with normally shaded cocoa, the first (nitrogen) is not needed, while phosphate if beneficial at all give their best effects in the presence of potash. Potash then appears to be the most valuable fertiliser on this soil type.

61. The experiments now to be described were designed to test the optimum dressing of sulphate of potash under five conditions.

1. Normal.
2. Pulverized manurial lime added at 5 tons per acre.
3. Superphosphate added at 600 lb. per acre.
4. Both lime and superphosphate added.
5. After trenching organic matter.

62. The interaction of potash with lime in the absence of superphosphate will be discussed first. The yield data expressed as lb. dry cocoa per acre are given below :

Treatment.		Natural yields 1935-36.	1st Expt. year 1936-37.	2nd Expt. year 1937-38.
3 lb. per tree	+L	580 } 616	770 } 824	888 } 929
	−L	653	878	970
2 lb. per tree	+L	785 } 633	1065 } 895	1143 } 916
	−L	480	725	690
1 lb. per tree	+L	685 } 675	962 } 859	1005 } 921
	−L	665	755	838
Control	+L	473 } 503	518 } 593	558 } 638
	−L	587	667	717
Average	+L	631	829	899
	−L	596	756	804

It is evident that the effect of liming is negligible in this experiment.

63. The same lime-potash test has been carried out in the presence of superphosphate (3 and 4 above). The yields are given in the table below.

Treatment.		Natural yields 1935-36.		1st Expt. year 1936-37.		2nd Expt. year 1937-38.	
3 lb. per tree	+L	540	582	1033	1042	1270	1274
	−L	623		1050		1278	
2 lb. per tree	+L	605	648	1113	1100	1214	1182
	−L	690		1087		1150	
1 lb. per tree	+L	450	503	703	789	976	952
	−L	557		875		927	
Control	+L	505	570	570	653	770	743
	−L	635		735		717	
Average	+L	525		855		1,058	
	−L	626		937		1,018	

64. The effect of liming in this experiment is again negligible.

65. Thus from both experiments it may be concluded that liming River Estate soils does not result in any increase of cocoa crop within two years after applying the lime.

66. The potash effects may now be considered.

Treatment.		Natural yields, 1935-36.		1st Expt. year, 1936-37.		2nd Expt. year, 1937-38.	
3 lb. per tree	+ super	582	599	1,042	933	1,274	1,102
	− super	616		824		929	
2 lb. per tree	+ super	648	641	1,100	998	1,182	1,049
	− super	633		895		916	
1 lb. per tree	+ super	503	589	789	824	952	937
	− super	675		859		921	
Control	+ super	570	536	653	623	743	690
	− super	503		593		638	
Average	+ super	576		896		1,038	
	− super	607		793		851	

67. The above figures demonstrate clearly that over the control plots the benefit from superphosphate is small if any and the whole of the very significant increase in crop due to superphosphate is obtained when it is applied with potash. *Furthermore the benefit obtained from the standard dressing of superphosphate (600 lb. per acre) increases in proportion to the amount of potash applied.*

68. On the basis of natural yields the expected yields for the experiment can be calculated. The increase over expected yield gives a measure of the effect of potash alone in increasing doses. In the case of the experiment which received no phosphate the figures are :—

Treatment.	1st Experiment year, 1936-37.	2nd Experiment year, 1937-38.	Total.
3 lb. per tree	379	517	896
2 lb. per tree	361	340	701
1 lb. per tree	216	298	514

69. This shows clearly that the greatest increment of yield, per unit of potash applied, is for the 1 lb. per tree application (300 lb. per acre).

70. Similar figures have been calculated for the experiment where superphosphate was applied. These are given in the table below.

Treatment.	Increase over Expectation.		Total.
	1st Experiment year, 1936-37.	2nd Experiment year, 1937-38.	
3 lb. per tree	238	329	567
2 lb. per tree	254	222	476
1 lb. per tree	141	177	318

71. In this case the greatest increase per unit weight of applied potash is still for the smallest application and the increment for larger applications decreases regularly.

72. The balance sheet to date is interesting.

Fertiliser.	*Cost.	Value of cocoa to date.	
		No super.	Super.
3 lb. per tree	$45 00	$44 80	$28 35
2 lb. per tree	30 00	35 05	23 80
1 lb. per tree	15 00	25 70	15 90

* Two applications.

73. For the block which received no superphosphate there is a $10 increase of cocoa for each $15 spent on fertiliser after the first. Clearly only the lowest application is profitable at present prices. In the case of the block where superphosphate was applied, less spectacular results were obtained and the increases from the superphosphate and potash were only as good as from potash alone in the first experiment. Where superphosphate was not applied results were lower.

74. In the following experiment the effect of increasing doses of potash on a recently trenched field is discussed. The yields, expressed as lb. of cocoa per acre, are given below for the first two experiment years.

Treatment.	1st Experiment year, 1936-37.	2nd Experiment year, 1937-38.	Total.
3 lb. per tree	953	934	1,887
2 lb. per tree	835	829	1,664
1 lb. per tree	680	747	1,427
Control	703	655	1,358

75. In this case, where a basic dressing of pen manure was given, the greatest increment per unit application of potash is for 2 lb. per tree (600 lb. per acre) but the differences are here less spectacular owing to the apparently very beneficial effect of the organic manure.

Method of applying Pen Manure—Code No. A. 19.

76. In 1936 a 4×4 latin square experiment was devised to compare the relative values of different methods of applying pen manure to sandy loam soils which are deficient in humus.

77. The three methods under comparison were :—

1. Trenching.
2. Mulching.
3. Mulch lightly forked.

78. In past years, both mulching and trenching have been done at River Estate with good results. The trenching system developed from the mulching system when it was feared that the surface mulch drew the feeding roots of the cocoa trees to the surface, where in times of drought they suffered from water shortage. Pits followed the mulching but to accommodate long branches of dead cocoa trees and lopped Immortel trees, the trenching system was evolved.

79. Unlike the pits the trenches acted to some extent as drains.

80. The costs of applying organic matter in the three ways used in the experiment are detailed below :—

1. *Trenching.*

	Per acre.
Digging trenches	$7 20
Raking in surface litter	4 00
Extra mulch and debris	1 20
Stumping and cutting Immortel roots	1 20
Heading manure and mulch to trenches	8 00
Covering in trenches	3 00
Total labour	24 60
16 tons pen manure at $1.50 per ton ...	24 00
Total cost	$48 60

(Against this total there could be considered the value of the trenches as drains which might otherwise have to be dug, say $5 and the value of the hoe weeding $4.

The net cost of trenching would thus be $39.60 *per acre*.)

2. *Mulching.*

81. The cost of mulching works out at $32.00 per acre, $24.00 being the cost of the manure and $8.00 the cost of heading and scattering.

3. *Mulch lightly forked.*

82. The additional cost of rough forking amounts to $6.00 per acre hence the cost of this treatment is about $38.00 per acre.

83. The effect of trenching can be seen for five to eight years after the operation has been carried out and so the cost must be balanced against the increased crops for this period. In the course of the experiment, the actual period over which benefits are obtained will be clearly illustrated from a comparison of the yields of treated and control plots.

Results.

84. In the table below, yields have been converted into pounds of dry cocoa per acre. The total area occupied by each treatment is one-third acre, with plots one-twelfth acre each.

YIELD OF PEN MANURE EXPERIMENT.

Treatment.	(LB. DRY COCOA PER ACRE.) 1st Experiment year, 1936-37.	2nd Experiment year, 1937-38.	Total 2 years.	Due to method.
Control	472.8	413.4	886.2	...
Trenches	560.4	730.5	1,290.0	404.7
Mulch	634.8	721.8	1,356.6	470.4
Mulch forked	699.6	804.9	1,504.5	618.3

BALANCE SHEET TO DATE (2 YEARS).

Treatment.	Amount of Cocoa.	*Value of Cocoa.	Cost of operation.	Deficit to date.
Trenches	404.7	$20 24	$39 60	$19 36
Mulch	470.4	23 52	32 00	8 48
Mulch-forked	618.3	30 92	38 00	7 08

* At 5 cents per lb. in the field—allows 1¼ cents per lb. for manufacture.

85. The increased yields above are quite statistically significant and there is little doubt that in one more year the debt on the mulching treatments will be wiped off, leaving any additional benefit as pure profit.

Trenching and Fertilisers—Code No. A. 20.

86. On the sandy loam soils of River Estate there is no doubt that both pen manure applications and certain artificials are extremely beneficial. In the experiment now to be described a direct comparison has been made between these two.

87. The experiment is designed in the form of a 4×4 latin square with 36 trees per plot.

88. The main plot treatments are —

1. Control.
2. Trenching with pen manure.
3. Six hundred pounds sulphate of potash—600 lb. superphosphate per acre.
4. The combination of 2 and 3.

89. In addition, each main plot was sub-divided at the start into half plots, one of which, chosen at random, was given a pulverised manurial limestone treatment at the rate of 5 tons per acre. The trenching and lime treatments were given only in 1936. Fertilisers were applied for three consecutive years.

90. The trenches were constructed as in experiment Code No. A. 19.

91. The yield data for two crops is now available and is presented below in terms of lb. of dry cocoa per acre.

92. In neither year was the difference in yields between lime-treated half plots sufficient to suggest benefits from liming. In the second year there was a slight difference of 5 per cent. in favour of liming but this is well within the range of experimental error.

93. The beneficial effects of pen manure and fertiliser treatments are both statistically significant.

94. The results expressed as lb. dry cocoa per acre are given below.

Treatment.	Yield 1936-37.	Yield 1937-38.	Total.	Increase due to fertiliser.
Control	538	535	1,073	...
Trenching	640	658	1,298	225
Artificials	725	842	1,567	494
Artificials and Trenching	782	863	1,645	572

BALANCE SHEET.

Treatment.	Cocoa due to treatment.	Value.	Cost of treatment.
Trenching	225	$11 25	$39 60
Artificials	494	24 70	42 00
Artificials+Trenching	572	28 60	81 60

95. In two years trenching has been responsible for an increase of one fanega per acre per annum, fertilisers for twice that amount. Both are beneficial if superimposed but the increased yield in this case is not equal to the sum of the increases due to trenching and artificials separately.

96. Although the plots treated with artificials have more capital debt to meet than the trenched plots the greater benefits have enabled these plots to pay off more than half that debt in two years. The final balance sheet cannot be considered until several more years have elapsed in order that the residual value of the manures can be assessed.

Code No. A. 18.

97. This is an experiment which was designed to compare the relative values and interaction of sulphate of potash and superphosphate *on a recently trenched field.*

98. The layout consisted of a 4×4 latin square with 25 trees per plot.

99. Yield records for two years are now available and are given below as lb. of dry cocoa per acre.

Treatment.	1st Expt. Yr. 1936/37	2nd Expt. Yr. 1937/38	Total
Control	540	639	1,179
600 lb. potash per acre	760	821	1,581
600 lb. superphosphate per acre	598	653	1,251
Potash and superphosphate per acre	613	780	1,393

100. If the total yields are arranged as in the table below it is evident that on this site as with others at River Estate phosphate is of little value and all the increase is attributable to the potash application.

Treatment.	Control.	Potash plots.	Total.
Control	1,179	1,581	2,760
Superphosphate plots	1,251	1,393	2,644
Total	2,430	2,974	—

101. The experiment was laid down on an area where thrips were a constant menace to the cocoa trees. Yields have not improved, even with fertilisers, to the extent expected. During 1938 the area was thoroughly drained and roundridged. Thrips have been less severe since.

Code No. A. 40.

102. This experiment was laid down in 1937 as a sulphate of potash *versus* basic slag trial with a half plot sugar treatment (3,000 lb. per acre).

103. There were two points to be tested :
(1) the value of basic slag ;
(2) the value of pure carbohydrate.

104. Basic slag is an alternative source of phosphates to the more widely used superphosphate and within recent years it has been produced in a more easily dissolved state than formerly. It is still much less soluble than superphosphate but it is not acid in reaction. It was felt that such a phosphatic fertiliser might be useful for cocoa on highly acidic soils. Both slag and potash were applied at the rate of 600 lb. per acre.

105. The half plot sugar treatment is entirely novel and arose from the researches of
1. Professor Hardy, who demonstrated the fact that in good cocoa fields the C/N ratio of the surface 6 inches of soil was relatively high ;
2. E. E. Pyke, who demonstrated mycorrhizal symbiosis in cocoa roots ;
3. The value of pen manure on cocoa but the disadvantage of inorganic nitrogenous manures.

106. The test was hoped to show whether the value of pen manure was solely that of the potash and phosphate contained in it or whether the carbohydrate content was also important.

107. The results for the first year of this experiment are very striking ; they have been translated into lb. of dry cocoa per acre and given below.

Treatment.		Yield as lb. dry cocoa per acre.	Increase due to Manure.
Control	+Sugar ...	636 } 688	...
	—Sugar ...	739 }	
Potash	+Sugar ...	873 } 770	82
	—Sugar ...	667 }	
Basic Slag	+Sugar ...	794 } 636	Loss.
	—Sugar ...	477 }	
Slag+Potash	+Sugar ...	856 } 765	77
	—Sugar ...	674 }	
Average	+Sugar ...	790	151
	—Sugar ...	639	—

108. There is no doubt that basic slag played no part in increasing yields during the first experiment year and that the increases shown for main plot treatments is due entirely to the potash application.

109. The half plot sugar treatment shows nearly 1 bag per acre better yield for the treated plots, *i.e.* a difference of 23.7 per cent. which is very creditable for the first year.

110. The sugar applied was naturally very expensive but if promising results can be obtained, the sugar need not be refined and minced canes spread as a mulch over the cocoa beds or even molasses should answer better than the refined sugar used in the experiments.

Demonstration Experiment in Field 25.

111. In 1914 this field was planted with four blocks of budded clones of 28 parents and two blocks of seedling progeny from the same parents as the budded clones. The clones each consist of series of 10 trees.

112. For the purposes of this demonstration experiment five of each ten trees were treated with standard fertiliser (600 lb. superphosphate+600 lb. sulphate of potash per acre) while the other five were left untreated for comparison.

113. The whole field was trench manured in 1935.

114. The yields expressed as lb. dry cocoa per acre are given below for the clones in blocks of seven.

Treatment.	Year.	Clone 1-7.	Clone 8-14.	Clone 15-21.	Clone 22-28	Average
Trenched	1936-37	614 } 656	487 } 499	656 } 626	728 } 670	613
	1937-38	697 }	511 }	596 }	611 }	
Trenched and Artificials	1936-37	899 } 921	733 } 751	906 } 889	924 } 867	857
	1937-38	942 }	768 }	872 }	810 }	

Balance Sheet.

Increased yield per acre due to treatment.	Value at 5 cents per lb.	Cost of fertilisers per annum.	Deficit (on two years) to date.
244 lb.	$12 20	$21 00	$17 60

115. The third application will constitute the last treatment, after which residual effects will be accounted to pay off the deficit and provide the profit.

Results of Experiments on Minor Crops.

1. *Grapefruit and Oranges.*

116. A block each of clonal March grapefruit, Valencia Oranges and King Oranges were planted during the year in preparation for manurial experiments. The first application of manures will be made in 1939. These experiments are in the nature of N.P.K. trials to supplement the results with cocoa.

2. *T. 1. Limes.*

117. The small fertiliser experiment on young T. 1. limes gave its first yield records during the year and indicated that N.P.K. treatments are probably having an effect even on these very young trees. Owing to the large tree to tree irregularity of crop due to variations in size of the trees no definite pronouncements will be made yet.

3. *Coffee.*

118. The coffee progeny trials have not yet given crop. Growth in the trees is slow and some yellowing occurs, due, it is thought, to insufficient overhead shade. Alternate plants were given a small dressing of mixed fertiliser but no results are apparent yet.

4. *Papaws.*

119. Owing to the interest being shown in a possible papain industry by the Agricultural Society 15 acres of papaws were planted in 1937 spaced 12 by 12 ft. Half of the seedlings turned out to be male trees, and most of the remainder succumbed to virus wilt during 1938. No extractions of papain were made since interest in the industry had waned.

5. *Tonka Beans.*

120. The planting of a trial of dwarf *versus* normal progeny has been completed but it will be several years before experimental data is obtained. The "dwarf" parents selected at River Estate were all old but small trees, which usually gave a good crop. Real dwarf tonka bean trees have now been discovered which will provide material for a further experiment.

121. The 7 × 7 latin square fertiliser experiment on young trees, planted at the end of 1935 appears to be showing results, for the number of bearing trees over the area covered by the experiment is much greater than for the remainder of the field.

122. Yield records were not taken in 1938 as it was not anticipated that sufficient trees would be bearing. For the 1939 crop it is evident that a number of the trees will be producing more than 100 fruit each and recording will be commenced.

123. In the field of 18-20 years old trees, the randomised block treatment with manures first applied in 1936, has at last shown what appears to be a response to the fertiliser and pen manure treatments. It will be recalled that there were no visible results in the 1937 crop.

124. The yield data is given below in terms of actual beans reaped. The beans are worth approximately 0·8 cents each on which basis the value of the increased crop has been calculated.

Treatment.	Average Yield 1936 and 1937.	Yield 1938.
Control	21,854 per acre	32,912 per acre
20 tons pen manure per acre	22,327 per acre	37,040 per acre
Mixture of equal parts of superphosphate and potash at rate of 440 lb. per acre per annum	19,224 per acre	44,378 per acre

125. Both the pen manure and artificial fertiliser treatments have given strikingly better yields than the control in the 1938 crop. The fertiliser treatment to date cost $30.80 per acre for two annual applications. The yield in 1938 ascribable to the fertilisers is over 15,000 beans, valued at $120 which pays off the capital debt of fertilising and leaves a large margin of profit.

C.—MARPER ESTATE.

Witchbroom testing Nurseries.

126. The work of converting a portion of Marper Estate into a witchbroom testing nursery in which strains of cocoa which are thought to be resistant are put under trial, has been pushed forward rapidly during the past 12 months.

127. A difficulty was experienced in finding an area large enough to accommodate the material in view, without interrupting the fertiliser and cultural experiments now in progress there, but towards the end of the year Government purchased 16 acres of land adjoining the Marper boundary which will be used for extending the nursery. There will now be room for testing 30,000 plants growing at six feet apart.

128. A further difficulty was experienced in bulking up supplies of budded and seedling plants from local selections. Most of the trees are in such a poor state of health that to obtain 100 budded plants and 500 seedlings is almost an impossible task. The clones of budded trees will be completed in 1939 by using buds from the budded supplies already planted.

129. No comparative figures of witchbroom incidence have been taken as yet, but it is quite clear that if any of the local selections are resistant to the disease they are far from being immune. This puts us back to the Amazon population which does appear to show immunity. Before the end of 1939 a number of these plants will have shown whether they can survive one year of spore showers without getting infected.

Routine of the estate.

130. On the remainder of the estate routine work has been carried out as usual. All fields were cutlassed twice during the year, some were given a light pruning in May at a cost ranging from 50 cents to 60 cents per 100 trees, and four fields were given a rather heavy pruning at from 75 cents to 90 cents per 100 trees. Practically the whole estate was sprayed with Bordeaux Mixture at the end of the dry season.

131. Drains were cleaned over the greater part of the estate and in Field 6—which was converted into the witchbroom testing nursery—8,455 feet of new drains were constructed.

132. The usual strict attention was given to witchbroom control. During the year each tree was cleared of disease four times, once during each quarter. The diseased tissue removed amounted to 568,843 brooms and 21,452 diseased pods. The cost of this control amounted to $485.35, which is equivalent to $5.19 per acre, not including supervision.

133. The known loss of crop due to witchbroom incidence since 1932 is given below where it will be seen that the incidence increased in 1937, but was considerably lower in 1938. This is very low compared with the 50 to 70 per cent. infection reported for nearby properties.

Year.	1932	1933	1934	1935	1936	1937	1938
Loss per cent. ...	0.87	1.25	1.33	1.31	3.84	8.67	3.51

134. No fruiting bodies were found on the diseased tissue which suggests that the three-monthly control is adequate if carried out thoroughly.

135. The distribution of crop and the incidence of witchbroom pods during the year are shown in the following table :—

Date of Reaping, 1938.	Healthy pods.	Witchbroom pods.	Total pods.	Percentage diseased.
January	144,262	2,542	146,804	1.73
March	200,288	5,868	206,156	2.84
April	70,842	5,187	76,029	6.80
May	27,386	2,132	29,518	7.22
June	48,346	636	48,982	1.21
July	48,366	636	49,002	1.30
August	10,729	515	11,244	4.58
September	11,358	559	11,917	4.69
October	11,214	467	11,681	4.00
November	8,067	1,437	9,504	15.12
December	9,187	1,473	10,660	13.82
Total	590,045	21,452	611,497	—

136. The number of pods reaped was 611,497, of which 21,452 were affected by Witchbroom disease representing a loss of 3.51 per cent.

Thrips and Beetles.

137. Both these pests were scarce during the year.

Rainfall and Yield.

138. The annual rainfall and crop records since 1931 are given in the accompanying table :

	1931	1932	1933	1934	1935	1936	1937	1938
Rainfall in inches	97.4	101.7	141.8	83.6	108.7	103.8	70.3	138.3
Yield (bags of 165 lb.) ...	196	211	202	204	292	217	193	305

139. It is interesting to note that in both instances where the rainfall dropped, the crop in the following year improved remarkably. Very poor setting took place towards the end of 1938 and this will be reflected in an unusually poor crop in 1939. The crop was sold as usual to the Cocoa Planters' Association.

Fertiliser Experiments

Experiments on Manzanilla Loams.

Soil Analysis of Marper Vega.

pH.	P_2O_5	K_2O
5.2	17	106

140. In many respects these soils resemble the Moruga sands and silts; and they are fundamentally mixed. There may be sandstone hills with limestone outcrops and silty vegas all within a 100 acre block, a feature which makes fertiliser experiments a difficult undertaking.

141. The Government Estate (Marper Farm) so happens to be situated at the junction of several soil types which is unfortunate. However, the series of fertiliser experiments which were laid out in 1930 have given surprisingly good results considering the heterogeneous nature of the soil.

142. The details of these experiments have been described in a separate publication* so that for the present purpose a brief skeleton description of their extent and layout is needed.

143. There are eight series constituting a test of :

1. Lime.
2. Potash.
3. Phosphate.
4. Nitrogen.
5. Nitrogen and potash.
6. Nitrogen and phosphate.
7. Potash and phosphate.
8. Nitrogen, potash and phosphate.

144. Every series consisted originally of 20 blocks of 25 trees each, designed to give 5 random replicas of each of four treatments.

145. The treatments were :

(1) Control.
(2) " Single " dose of fertiliser.
(3) " Double " dose of fertiliser.
(4) " Triple " dose of fertiliser.

146. The single dose for lime was 5 tons per acre, for potash 100 lb. sulphate of potash per acre, for phosphate it was 325 lb. superphosphate per acre and for nitrogen 250 lb. of sulphate of ammonia per acre.

147. Manures were applied in 1930, 1932, 1934, 1936, 1937 and 1938 except lime, in which case the only second dressing was the " single " dose repeated in 1934.

148. The results were analysed in 1935 and although there were marked and significant benefits from lime, potash and phosphate applications, there was no benefit from the nitrogen applications.

149. At the beginning of 1936 the experiments were modified.

150. Each plot of 25 trees was subdivided into two of 10 trees each leaving the five trees in the middle as a guard row. In the case of the lime series, sulphate of potash at the rate of 500 lb. per acre was applied to random half plots

151. In the case of the potash, phosphate, and potash+phosphate series, ground limestone at the rate of 5 tons per acre was applied as a half plot treatment. In the nitrogen series, potash formed the half-plot treatment and in the others the nitrogen was withheld from half plots chosen at random.

152. Records of pods are known for these half plots since 1933, so that the yields from 1933-1936 serve as previous records on which judgment of the new treatments can be taken.

153. The estate is kept in excellent condition. The trees get a light pruning to remove witchbroom several times per annum and once per annum they are sprayed with Bordeaux Mixture as a guard against thrips. Drainage over the experiment plots is faultless.

154. Thus it comes about that in 1937-38 the estate produced a record crop, yields exceeding 1,000 lb. of dry beans per acre were obtained from several manurial plots, while neighbouring estates, although relatively good, rarely exceeded 150 lb. of dry beans per acre.

155. Brief notes on the results of each experiment to date will be given. All yields have been expressed as lb. of dry cocoa per acre for the sake of comparisons.

Note on cost of application of fertilisers.

156. When these experiments were laid down the method of applying fertilisers was to rake all the debris on the soil to form a heap around the tree trunks, leaving a clear area over which the requisite amount of fertiliser was broadcast. Then the debris was spread again as a mulch over the fertilised bed. According to this plan it cost $2.00 to $3.00 per acre to apply fertilisers and when it was found that simple broadcasting over the weeds and debris answered just as well the former elaborate method was abandoned.

157. In these experiments the cost of application has been reckoned at 20 cents per acre since that is the cost when large fields are being treated. Naturally the cost of applying fertilisers to small and complicated blocks of an experiment was greater than this.

(1) *Lime Series.*—Ground Limestone was applied in 1930 at three rates, 5, 10 and 20 tons per acre. Only the 5 ton per acre application was subsequently repeated in 1934. Thus in 1938 the cost per annum of the 5 and 10 ton applications is identical while the 20 ton per acre application cost twice as much.

158. When the yields were summarised up to the end of 1935 all the lime treatments gave significantly better yields than the control plots but there were no differences between the actual treatments.

159. Now that three more years can be included in the comparisons the initial 10 ton per acre treated plots have walked away from the initial 5 ton per acre plots although those plots received a second dressing in 1934.

160. From 1936 the potash treated half plots, originally slightly lower yielding than their untreated other halves, have shown considerably better yields than the control halves. Although the cocoa obtained has not paid the current costs of fertilising other experiments show that there are likely to be large residual effects from potash manuring.

*" Results of Manurial Experiments on Cacao at Marper " by F. J. Pound and J. de Verteuil, *Tropical Agriculture*, Vol. XIII, No. 9 pp. 233-241.

161. The yield statistics are given in the table below expressed as lb. of dry cacao per acre.

Treatment.	Average yields per acre 1933-36.		Yields per acre 1936-37.		Yields per acre 1937-38.	
*Cao k.	476	477	612	561	882	863
Cao	477		510		843	
Ca_1k.	598	642	703	685	1,138	1,093
Ca_1	686		666		1,048	
Ca_2k	674	720	870	802	1,265	1,260
Ca_2	765		734		1,254	
Ca_3k	640	672	918	801	1,423	1,313
Ca_3	703		684		1,202	
+K	597		776		1,177	
—K	658		648		1,087	

Effect of lime to date.

Treatment.	Average yields per acre.	Difference due to lime.	Value of Cacao	Cost of lime.	Profit.
			$ c.	$ c.	$ c.
Control	571	...	...	...	...
5 tons per acre	741	170	8 50	8 12	0 38
10 tons per acre	844	273	13 65	8 12	5 53
20 tons per acre ...	826	255	12 75	16 24	...

* Cao=No lime applied.
K=Potash at 500 lb. per acre applied in 1936 and 1937.

2. *Nitrogen Series.*

162. When the results were analysed at the end of 1935 it was evident that sulphate of ammonia applications were of no benefit whatsoever to cocoa, thus bearing out results obtained on other cocoa soil types.

163. The present examination of yields for the 1933-36 period suggests that the accumulated effects of nitrogen applications were actually becoming detrimental and this is borne out by the yields in 1936-37 and 1937-38.

164. Potash treated half-plots have shown a tendency to correct this nitrogen effect but the reaction is much slower than would be expected judging by the normal effect of potash. It would appear as though the ill effects of the nitrogen applications hang over, and prevent the usual response to potash.

165. The yield data expressed as lb. of dry cocoa per acre is presented below.

Nitrogen Series.

Treatment.	Average yields per acre 1933-36.		Yields per acre 1936-37.		Yields per acre 1937-38.	
*N_0K	442	423	531	491	876	831
N_0	404		450		786	
N_1K	331	348	474	453	820	698
N_1	365		432		575	
N_2K	307	343	389	418	632	697
N_2	378		447		761	
N_3K	388	356	478	431	823	799
N_3	327		384		774	
+K	367		468		788	
—K	369		428		724	

Inference: Potash, beneficial; Nitrogen, harmful.

Treatment.	Average yield of half plots; 1933-36.	Expected yield 1937-38.	Actual.	Gain.
+K	367	720	788	68 lb.
—K	369	724	724	—

* No =No sulphate of ammonia applied.
K =Sulphate of potash at 500 lb. per acre in 1936 and 1937.

3. *Potash Series.*

166. In the analysis of results up to 1935, the benefits from potash applications stood out very significantly and the "triple" dose treatment (300 lb. per acre every second year) was profitable with cocoa valued at 5 cents per lb.

167. At the present time the cost of potash fertilisers has decreased considerably as well as the cost of application so that over the five year period now being examined, profits are greater. In fact one is led to suspect that continued applications of 100 lb. per acre will eventually be the most profitable.

168. The half plot lime treatments inaugurated in 1936 have not shown any marked benefit as yet but in this case it may be due to the fact that natural limestone rock out-crops in this experiment.

169. The yield data is given below as lb. dry cocoa per acre.

Potash Series.

Treatment.	Average yields per acre 1933-36.		Yields per acre 1936-37.		Yields per acre 1937-38.	
CaK_0	335	309	467	401	729	676
K_0	283		334		622	
CaK_1	375	416	484	540	721	844
K_1	457		595		966	
CaK_2	452	439	569	503	1,010	901
K_2	426		438		792	
CaK_3	472	509	570	614	980	1,004
K_3	546		658		1,028	

Inference: Potash, beneficial; lime not so.

Effect of potash for 5 years.

Treatment.	Average yield per acre.	Difference due to fertilisers.	Difference.
Control	401	...	...
100 lb. per acre	526	125	...
200 lb. per acre ...	544	143	18
300 lb. per acre	629	228	103

Balance Sheet.

Treatment.	Cocoa due to	Value at 5c.	*Cost of Fertiliser.	Profit.
		$ c.	$ c.	$ c.
100 lb. per acre ...	125	6 25	2 00	4 25
200 lb. per acre ...	143	7 15	4 00	3 15
300 lb. per acre ...	228	11 40	6 00	5 40

*4 applications in 5 years.

170. Since the triple treatment plots were better yielding at the start it is possible that the 100 lb. per acre treatment will be the most profitable.

4. *Phosphate Series.*

171. In the 1935 analysis, applications of phosphate were not only significantly beneficial but also profitable, although less so than potash.

172. The present analysis fully bears out these conclusions and shows very definitely that the increase in yield from the "double" dose is not twice that resulting from the "single" dose whereas there is probably no significant additional benefit from the "triple" dose. The most economical dose is definitely the 325 lb. per acre application. The profit per acre now, with cocoa valued at 5 cents per lb. in the field is $2.50, more than twice what it was in 1935.

173. As with the potash series the half plot lime application shows no benefits. The reason may be the same as that suggested above.

174. The yield data of this experiment is given below in lb. of dry cocoa per acre.

Treatment.	Average yields per acre 1933-36.	Yields per acre 1936-37.	Yields per acre 1937-38.
CaPo	445 } 412	550 } 467	988 } 842
Po	379	383	695
CaP_1	504 } 503	537 } 553	997 } 1,015
P_1	501	569	1,032
CaP_2	559 } 482	779 } 630	1,281 } 1,181
P_2	404	480	1,081
CaP_3	592 } 509	679 } 588	1,268 } 1,183
P_3	426	496	1,098
+Ca	525	636	1,134
—Ca	428	482	977

Inference : No benefit from liming.

Effect of Phosphate for 5 years.

Treatment.	Average yield per acre.	Difference due to fertilisers.	Difference.
Control	509	...	...
325 lb. per acre	615	106	...
650 lb. per acre	651	142	36
975 lb. per acre	660	151	45

Balance Sheet.

Treatment.	Cocoa due to lb.	Value at 5 cents.	*Cost of fertiliser.	Profit.
325 lb. per acre	106	$5 30	$2 80	$2 50
650 lb. per acre	142	7 10	5 60	1 50
975 lb. per acre	151	7 55	8 40	...

* 4 applications in 5 years.

Inference : Most profitable application 325 lb. superphosphate per acre.

5. *Nitrogen and Potash Series.*

175. The 1935 analysis revealed the fact that the expected benefits from potash applications were not realised when this manure was applied mixed with sulphate of ammonia. It is quite clear that sulphate of ammonia by itself is, if anything, slightly detrimental to cocoa yields.

176. The present analysis supports the earlier conclusions and while there are definitely increases in yield ascribable to the manured plots these increases are lower than the corresponding increases due to potash alone.

177. In 1936 nitrogen was omitted at random from half plots but the omission has not made itself conspicuous in plot yields in two years.

178. As with the potash half-plot treatment in the nitrogen series the answer may be found in the hang-over effects of nitrogen, which are not immediately dissipated by potash.

179. The yield data is given in the table below expressed as lb. of dry cocoa per acre.

Treatment.	Average yields per acre. 1933-1936.	Yields per acre. 1936-37.	Yields per acre. 1937-38.
N_0K_0	319	383	623
K_0	...	...	...
N_1K_1	418 } 392	498 } 497	860 } 835
K_1	366	496	810
N_2K_2	366 } 393	440 } 507	747 } 869
K_2	420	574	990
N_3K_3	350 } 356	449 } 425	841 } 823
K_3	362	400	804
+ N	378	462	816
— N	383	490	868

Inference : Omission of nitrogen not yet showing effect.

EFFECT OF NITROGEN AND POTASH FOR 5 YEARS.

Treatment.	Average yield per acre.	Difference due to fertilisers.
Control	393	...
N_1K_1	502	109
N_2K_2	511	118
N_3K_3	463	70

Increases are less than for potash alone, showing general detrimental effect of nitrogen.

6. *Nitrogen and Phosphate Series.*

180. In the 1935 analysis it was very definite that the yields of treated plots, compared with those of the control plots, were of the same order as for the phosphate series above and although it could not be claimed that nitrogen was actually detrimental it certainly was not beneficial.

181. No change in the position is apparent in 1938 beyond the fact that there is a better indication of possible detrimental effects due to nitrogen.

182. From 1936 onwards nitrogen was omitted from half plots and although two crop seasons have elapsed, there is no indication yet of improving yields on these half plots. As with the potash series it is probable that the trees are suffering from a nitrogen hang-over.

The yield data is given below expressed as lb. of dry cocoa per acre.

Treatment.	Average yields per acre. 1933-36	Yields per acre. 1936-37	Yields per acre. 1937-38
NoPo	309	314	627
Po	...	...	...
N_1P_1	336 } 348	404 } 359	676 } 690
P_1	360 }	314 }	704 }
N_2P_2	409 } 407	484 } 474	800 } 780
P_2	404 }	463 }	759 }
N_3P_3	436 } 393	526 } 459	902 } 857
P_3	350 }	391 }	812 }
+ N	394	471	793
− N	371	389	758

Inference : Omission of nitrogen not showing effect yet.

EFFECT OF NITROGEN AND PHOSPHATE FOR 5 YEARS.

Treatment.	Average yield per acre.	Difference due to fertiliser.
Control	374	...
N_1P_1	419	45
N_2P_2	495	121
N_3P_3	499	127

Increases are less than with phosphate alone—showing slight detrimental effect of nitrogen.

7. *Potash and Phosphate Series.*

183. When the 1935 analysis was made the sequence of results was spoilt by the high average yields given by the control plots. Field inspection has shown that there are more than the average exceptionally good bearing trees in these plots. Such accidents of design are always likely to occur and in cocoa they can produce very misleading effects.

184. Ignoring the yields of control plots, even in 1935 there was a greater difference between the single (K_1P_1) and either of the double (K_2P_2) or triple (K_3P_3) doses than the combined differences in the case of the potash and the phosphate series. The same result is obtained in a more exaggerated form in the 1938 analysis. The greatest jump however is from P_1K_1 to K_2P_2 which is actually more than 100 lb. per acre of cured beans better than the P_1 to P_2 jump added to the K_1 to K_2 jump.

185. The triple dose does not increase yields still further; rather the reverse.

186. This is a very important conclusion for it suggests that both potash and phosphate help the cocoa tree to absorb more readily its requirements of the other and that on Manzanilla soils any application above the "double" dose level is not only likely to be unprofitable but actually wasteful.

187. No conclusions can yet be drawn concerning the value of the half-plot lime treatment.

188. The yield data is given below expressed as lb. of dry cocoa per acre.

POTASH AND PHOSPHATE SERIES.

Treatment.	Average yields per acre 1933-36.		Yields per acre. 1936-37.		Yields per acre 1937-38.	
PoKoCa	534	576	708	689	1005	990
PoKo	618		671		974	
P_1K_1Ca	532	535	630	680	980	934
P_1K_1	538		730		888	
P_2K_2Ca	687	644	840	834	1432	1301
P_2K_2	600		828		1170	
P_3K_3Ca	670	645	766	733	1083	1177
P_3K_3	620		701		1272	
+Ca	606		736		1125	
−Ca	594		733		1076	

Inference : No effect of lime.
Experiment has exceptional control plots.

EFFECT OF POTASH AND PHOSPHATE FOR 5 YEARS.

Treatment.	Average yield per acre.	Difference due to fertilisers.
Control	681	—
P_1K_1	644	—
P_2K_2	813	169
P_3K_3	769	125

8. *Phosphate, Potash and Nitrogen Series.*

189. In the 1935 analysis the treated plots did actually give significantly better yields than the control plots but the increases were not as great as would be expected from potash and phosphate alone.

190. In the present analysis that is even more apparent. The omission of nitrogen since 1936 does not cause any jump in yields. There is only one conclusion, that the nitrogen is able to suppress the benefits which would be expected from the potash and phosphate applications.

191. The yield data is given below expressed as lb. of dry cocoa per acre.

N.P.K. SERIES.

Treatment.	Average yields per acre 1933-36.		Yields per acre 1936-37.		Yields per acre. 1937-38	
NoPoKo	580		656		1099	
PoKo	—		—		—	
$N_1P_1K_1$	568	621	627	697	964	1110
P_1K_1	673		766		1256	
$N_2P_2K_2$	620	568	709	616	1362	1191
P_2K_2	515		522		1020	
$N_3P_3K_3$	566	619	720	723	1006	1150
P_3K_3	671		726		1294	
+N	585		685		1111	
−N	620		671		1190	

EFFECT OF N.P.K. FOR FIVE YEARS.

Treatment.	Average yields per acre.	Difference due to fertilisers.
Control	699	...
$N_1P_1K_1$	734	35
$N_2P_2K_2$	702	3
$N_3P_3K_3$	746	47

Phosphate and potash benefits are destroyed by the inclusion of nitrogen.

DEMONSTRATION ACRE EXPERIMENTS IN MANZANILLA LOAMS.

1. *Liming.*

Treatment.	Yields per acre. 1936-37.	Yields per acre. 1937-38.
5 tons lime	132	184
Control	186	310

Inference : No benefit from liming.

2. *Superphosphate.*

Treatment.	Yields per acre, 1936-37.	Yields per acre, 1937-38.	Total.	Percentage increase over control.
600 lb. superphosphate	294	464	758	...
Control	186	310	496	52

Inference : Marked response to Superphosphate.

3. *Potash and phosphate forked.*

Treatment.	Yield per acre, 1936-37.	Yield per acre, 1937-38.
600 lb. Buccaneer phosphate, 600 lb. potash	376	690
Control	392	668

4. *Lime, potash and phosphate forked.*

Treatment.	Yield per acre, 1936-37.	Yield per acre, 1937-38.
5 tons lime, 600 lb. superphosphate, 600 lb. potash ...	546	636
Control	722	948

Inference : Neither treatment has yielded increases although one would expect at least a response from phosphate or potash. These examples illustrate the tricky nature of manurial requirements on Manzanilla soils where limestones, sandstones and other soil types are liable to be intermingled.

A special demonstration experiment on Manzanilla Loams.

192. Witchbroom disease is so severe in some of the Manzanilla cocoa vegas that large areas have been virtually abandoned and conditions similar to those found in South America exist.

193. It had already been proved that, at a cost of $3.00 to $5.00 per acre, per annum, this disease can be kept in check on a 100-acre block even though that block is surrounded by abandoned cocoa. The loss of crop in any one year up to the present has not exceeded 10 per cent.; in many years it has been below 5 per cent.

194. This was considered demonstration enough for the large proprietor but it was not considered good enough proof that a peasant proprietor with 5 acres could be expected to keep his witchbroom in check, if he were surrounded by dirty neighbours.

195. For this demonstration a 5-acre block was taken in the centre of a large area which had been abandoned on account of witchbroom infection. The site was chosen as containing more disease than any other place in the island.

196. The whole block was cleared of witchbroom early in 1937—an operation which necessitated removing 90 per cent. of the canopy. The block was cutlassed and drained. Five separate acre plots were marked out and given the following treatments :—

1. Control.
2. 5 tons lime.
3. 600 lb. superphosphate.
4. 5 tons lime, 600 lb. super.
5. 5 tons lime, 600 lb. super., 600 lb. sulphate of potash.

197. The manures were applied to the beds over the prunings and cutlassed weeds and the soil from the drains was scattered over the top to make turtle-backed beds.

198. At this stage planters prophesied that the whole block would die.

199. Half of each acre plot was sprayed with Bordeaux Mixture as soon as new foliage came out.

200. Half way through the crop season the yields looked so promising on these plots that a sixth acre of abandoned cocoa was included for yield records.

201. Here are the results for the 1937-38 crop expressed as lb. of dry cocoa per acre.

Treatment.	Control.	Lime.	Super.	Lime and super.	Lime, super and potash.	Average.
Sprayed	244	185	363	305	342	288
Unsprayed ...	341	189	395	323	208	291
Average ...	293	187	379	314	275	290
Average ...	240			323		

202. Over the whole 5-acre block the average yield was 290 *lb.* of dry cacao per acre. The absolute control acre taken in half way through the season gave 9½ *lb.* of dry cacao. No cocoa had been previously picked off this block so that the annual yield in any case could not have exceeded 20 *lb.*

203. The numbers of witchbroom infected pods reaped off the 5-acre blocks are given below :—

Treatment.	Control.	Lime.	Super.	Lime and super.	Lime, super and potash.	Average.
Sprayed	168	168	249	171	260	1,016
Unsprayed ...	314	205	234	379	162	1,294
Average ...	482	373	483	550	422	
Average ...	855 =428 per acre		1,455 =485 per acre.			

204. The loss of crop from infected pods amounted to 12 *per cent.* It cannot be claimed that this figure is low because infected pods were not counted. If 290 lb. of dry beans per acre were obtained from these abandoned plots it is evident that there could not be a great number of pods missed.

205. The manurial treatments have not had a very marked effect yet. There seems to be no effect of liming or potash. The Superphosphate treated plots averaged 83 lb. of dry cacao per acre more than those which received no phosphate.

206. Spraying had little effect on crop in the first year.

207. When it is realised that the average yields in Trinidad have recently dropped to below 200 lb. of dry beans per acre the reclamation of this 5-acre block is nothing short of miraculous. *It definitely proves that if a peasant proprietor,* even in a very severely infected witchbroom area, *likes to work* his cocoa he need suffer *very little loss from witchbroom* and even without the fertiliser treatments he should reap yields of at least 1½ bags per acre. *There is no excuse for any small peasant proprietor returning yields of less than 1½ bags per acre in normal years.*

General Conclusions for Manzanilla loams.

(1) Liming may be of benefit on areas where there are no nearby limestone outcrops but the effect is low. Potash after liming is very beneficial.

(2) Sulphate of potash alone is most profitable if applied annually at the rate of 100 lb. per acre and there is no advantage in applying heavier doses except in the initial application.

(3) Superphosphate alone is of less immediate value than potash but annual applications at the rate of 325 lb. per acre appear to be profitable. When applied with sulphate of potash it appears as though the two fertilisers both increase yields independently as well as helping the effect of the other.

(4) Nitrogen alone, depresses yields and depresses the benefits expected from potash and phosphate. When nitrogen is withheld from mixed dressings the trees take some little time to adjust themselves to the new conditions and there is no immediate improvement in yields.

(5.) In these areas witchbroom disease is a limiting factor but it has been proved that on a 100-acre block it can be controlled and yields maintained at 3 bags (500 lb.) per acre. On a 5-acre block without fertilisers yields were increased from 20 to 240 lb. in the first year of reclamation.

General.

208. Marper is an object lesson to all estates in the Manzanilla district. While we do not pretend to show a profit on the year's working—no experiment estate in this world could claim that—Marper Estate has demonstrated how witchbroom can be kept under control even in a very heavily infected district at a cost of about $5.00 per acre per annum, once its incidence has been brought to controllable dimensions.

209. Marper yields have shown a slight tendency to increase in spite of witchbroom losses while neighbouring estates have been abandoned owing to failure of crops.

210. One very important operation which helps the estate but which has not yet been given experiment testing for profitableness is the routine spraying with copper compounds. Not only are thrips completely controlled by this annual spraying, but leaf fall is reduced, and leaves may persist for 2 years on the trees. As a result, flushing is lessened and this gives a certain amount of witchbroom control.

211. The well formed and uniform canopy reduces weed growth beneath, which in turn reduces the cost of cutlassing.

212. The shade and drainage experiments have given results which are of very great fundamental importance to cocoa growing. The summary of yields to date are given below and from these figures it is evident that function No. 1 of a shade tree is drainage, and that drains are only necessary on the heavy Manzanilla loams when shade is reduced considerably.

Yields of Experiment Plots, 1930-1938.

(In lb. dry cacao per acre.)

Draining.	(80 PER CENT. SHADE.)								(50 PER CENT. SHADE.)								(33 PER CENT. SHADE.)							
	'31	'32	'33	'34	'35	'36	'37	'38	'31	'32	'33	'34	'35	'36	'37	'38	'31	'32	'33	'34	'35	'36	'37	'38
Drains at 26 feet	390	220	310	310	540	370	450	640	470	310	290	330	570	410	420	760	590	380	350	400	740	400	450	760
Drains at 52 feet	360	240	360	240	370	240	270	490	430	310	420	410	540	380	390	710	400	250	310	310	480	340	370	770
Drains at 104 feet	490	360	410	420	670	460	520	730	300	150	150	165	380	290	340	450	270	150	100	180	390	270	340	540
No drains	480	280	410	370	550	370	440	590	380	240	200	280	510	380	390	650	290	140	170	270	480	230	380	450

Summary.

Draining distance.	80 per cent. Shade.	50 per cent. Shade.	33 per cent. Shade.
26 ft.	464	445	509
52 ft.	321	449	404
104 ft.	508*	278	280
No drains	436	379	301
Average	417	388	374

* Somewhat undulating land.

213. The conclusions to be drawn are clear cut. With 80 per cent. shade (normal for most estates) there is no advantage in draining especially on undulating land, but as the density of shade decreases so the need for drains tends to increase.

214. In other words, drainage and shade trees are complementary, and drainage requirements vary inversely as the number of well grown shade trees per acre.

215. It is somewhat revolutionary to find that over a period of 8 years drains are superfluous with average normal shade on these heavy soils.

D.—FERTILISER EXPERIMENTS ON COCOA.

216. The fertiliser experiments have now become too many and too involved for separate report here. The annual report for the crop year September, 1937 to August, 1938, has been prepared and published. In it the experiments have been grouped according to soil into 10 classes. The summary of recommendations which have been drawn up from the yield data is reproduced below :

> "Fertilising must be looked upon as an operation like pruning and draining, which may not pay off the capital expense involved in the year during which the work is done, but in which the good effects are seen long after. It is probable that, like pruning and draining, efficiency can be obtained by a small annual upkeep once the initial capital expense has been incurred."

217. The problem at the present time is twofold, manuring to increase yields from the existing tree population, and secondly the building up of soil fertility in suitable areas in readiness for a more efficient population to come.

218. Under each soil-type the salient features of the manurial experiments will now be summarised and recommendations given where possible for improving the existing cocoa. Coupled with rehabilitation of suitable areas the recommended manuring will prepare a much improved soil fertility for young supplies.

2. *Princes Town (Black) Marl Soils.*

219. Soluble phosphates stand out in their ability to improve cocoa yields on this soil. Nitrogenous fertilisers tend to decrease yields and, if applied with phosphates, destroy much of the good effect of the latter. Potash fertilisers appear to be of no benefit, neither are forking liming or, strange to say, pen manure.

220. The best treatment is to apply superphosphate at 600 lb. per acre. Near the boundary with calcareous clays a small application of potash (either sulphate or muriate) may be beneficial.

3. *Calcareous Clays.*

221. Both soluble phosphates and potash are beneficial, the former more than the latter, and in this case the highly soluble nitrogen-phosphate manures may be useful provided the proportion of nitrogen to phosphate is small. Liming is not needed but increased yields follow forming and pen manure applications.

222. It is anticipated that the best treatment to make cocoa productive on calcareous clays will be rough forking with pen manure broadcast at the rate of 20 tons per acre, drains constructed 18 inches to 2 feet deep, spaced 28 feet apart and the soil thrown over the pen manure on the beds to make them turtlebacked. Finally, nicifos 4, mixed with an equal weight of sulphate of potash spread at the rate of 400 lb. per acre for the first year but reduced to 100 lb. in subsequent years should give additional benefits.

4. *Gypseous Brasso Clays.*

223. Neither phosphates nor potash have been found to increase yields on this soil type, and since the C/N ratio is low it is improbable that nitrogenous fertilisers will be of benefit either.

224. Pen manure applications are a speculation.

5. *Acid Clay Alluvium.*

225. Sulphate of ammonia and potash fertilisers have proved of no benefit to cocoa on this soil but soluble phosphates have given profitable returns in the San Rafael district when applied at the rate of 300 lb. (superphosphate) per annum. Liming as a long range speculation may be good, but the initial application should not exceed 5 tons per acre. Pen manure appears to be another long range speculation and forking may turn out to be beneficial in the long run. On the Guapo clays, superphosphate gives no benefit but there are indications that the highly soluble nicifos 4 will be beneficial.

6. *Heavy loams of Sangre Grande-Oropouche District.*

226. Small annual applications of superphosphate—say 300 lb. per acre may be beneficial and profitable. Lime at the rate of 5 tons or less per acre may prove a profitable long range speculation. Pen manure has not proved of great benefit, but spraying to control thrips does appear to be beneficial to crop.

227. Towards the boundary with calcareous clays, superphosphate is more beneficial, and towards the sandy loams potash becomes beneficial and so possibly do nicifos 4 and basic slag. Forking has shown no benefit even after two years.

7. *Moruga Sands and Silts.*

228. These soils are very tricky since the manurial programme will depend on whether phosphate or potash is most needed. Generally the sandy types require potash more than phosphate and the silty types have the reverse requirements. Frequently, however, both are needed. Potash, superphosphate and nicifos 4 have all proved valuable on some sites. Liming is not followed by any immediate increases of crop.

229. The best fertilising guide at present is to apply potash at the rate of 600 lb. per acre followed by smaller annual applications if the potash content of the surface 6 inches is less than 60 parts per million and highly soluble phosphates at the same rate if the phosphate content of the surface 6 inches is less than 30 parts per million.

8. *Manzanilla loams.*

230. Like the Moruga sands and silts these soils are variable, but yields exceeding 1,000 lb. of cured beans per acre have been obtained by good cultural work followed by constant applications of sulphate of potash at the rate of 300 lb. per acre and superphosphate at the same rate. Liming is slightly beneficial and probably profitable after several years. Not only is nitrogen harmful but the cocoa trees appear to suffer from a nitrogen hang-over which is only slowly dispelled by potash and phosphates.

231. Careful witchbroom control is essential in this district. It has been proved possible even on 5-acre blocks.

9. *Medium to Sandy Loams.*

232. Where the soil contains less than 60 parts per million of potash, applications of sulphate or muriate of potash give profitable returns. Where, in addition, the phosphate status is below 30 parts per million, soluble phosphates give added if not primary benefits. Liming is not immediately beneficial and nitrogen may be harmful although mulch and pen manure are very beneficial, especially if accompanied by pruning, and appropriate dressings of potash and phosphate.

233. The treatment to be recommended is a reasonably heavy pruning, followed immediately by bedded or lightly forked pen manure at the rate of 20 tons per acre with an initial dressing of 600 lb. sulphate or muriate of potash plus 300 lb. superphosphate and then annual dressings of the same fertilisers at $\frac{1}{4}$ to one-fifth the initial rate.

10. *Toco Soils.*

234. The Calcareous schist soils need and respond to heavy potash applications, while the Quartz schist soils give less response to potash, but in places require soluble phosphates. The Igneous rock soils appear to require no fertilisers.

11. *Tobago soils.*

235. These are divided into three groups. *The King's Bay district and Northwards* answers to both potash and phosphates especially after heavy pruning. Dressings at the rate of 600 lb. per acre of each as an initial dose followed by very small (100 lb. per acre of each application) as subsequent annual doses will probably prove the most economical. Although it was not tried, there is no doubt that bedding pen manure or other organic matter would also be beneficial.

The Richmond heavy clay soils do not respond well to fertiliser treatments. Potash is the most needed and the most beneficial fertiliser. Potash and phosphate forked with lime gave promising results and this may be considered as the best recommendation at present. The rate of application should be high at first followed by small annual applications.

The Roxborough and District soils answer to hard work, pen manure and potash, although phosphates are also beneficial and a small dressing of sulphate of ammonia with these manures is beneficial in places where the soil is shallow and the canopy thin. Liming appears to be of little benefit. Peasants who have worked well, applied pen manure and requisite fertilisers have reaped yields exceeding 1,000 lb. of cured beans per acre from their acre demonstration plots.

E.—FERTILISER EXPERIMENTS ON OTHER CROPS.

236. The experiments on limes and Tonka Beans being carried out at River Estate have been described in that section. On private estates there were additional experiments on Tonka Beans, Concnuts and Bananas.

237. The Tonka Bean experiments on old trees have been abandoned in favour of experiments with young trees. It was found impossible to take accurate plot yields in most cases and eye observations failed to distinguish any real fertiliser effects owing to the irregularity of bearing from tree to tree.

238. In no case where actual records were attempted from plots of large trees did any response occur until two years after the initial application of fertiliser, and on an estate in Tamana where large apparent increases were recorded for the 1938 crop the control plots gave larger proportionate increases than the manured plots.

239. On the other hand at River Estate where better control was possible apparently large profits were obtained as a result of fertilisers and pen manure applied two years earlier.

240. More experiments are planned for young trees in 1939.

241. As regards coconut experiments, the two N.P.K. trials now being conducted have shown no results after 18 months. It is probable that response will be very slow with this crop.

242. Banana experiments actually carried out by the Banana Officer have demonstrated that spraying to control Cercospora leaf spot is not economic, but that a fair degree of control can be obtained by light overhead shade. Good cultivation and manuring have been shewn to be answered by large increases of crop. These experiments are reported elsewhere.

F.—SEARCH FOR WITCHBROOM RESISTANT STRAINS OF COCOA.

243. The following summary is reproduced from the special report submitted on the return of the expedition.

> "The search for resistant types which began in Surinam and then spread to Ecuador and Trinidad as each country in turn became afflicted was finally directed to the tropical Amazon river plain.
>
> Here it was discovered that Surinam and Ecuador are not isolated centres of the disease but are merely the outlying areas of a much larger and much more severely infected area covering the whole of the Amazon valley.
>
> Certain trees which appeared relatively resistant to the disease in Ecuador have been propagated by seed and probably 1 per cent. of the progeny are highly resistant and also relatively high yielding. These trees have provided material for further work in breeding out a totally immune variety.
>
> In the valley of the Amazon, suspicions born in Ecuador concerning the effect of light and/or reduced humidity on the intensity of the disease, have been confirmed and with the lower Amazon type of cacao certain trees appeared to be endowed with complete immunity if they were isolated and exposed to bright sunlight.
>
> In the case of certain varieties growing wild in the upper Amazon and its tributaries segregation of highly resistant trees has taken place, not only under conditions of exposure such as found in the lower Amazon but also under conditions which may well be duplicated on a plantation scale. Some of these trees appear on inspection to have no disease at all in spite of growing within a few feet of extremely heavily infected neighbours.
>
> It is not improbable that this resistance has given the sunlight induced resistance to the hybrid complex lower down the river.
>
> Known susceptible varieties of cacao growing in the Colombian Cordilleras at altitudes of 3,000 to 4,000 feet are not infected with Witchbroom although infected cacao occurs at sea-level not far away.
>
> Unless the mountains have formed a truly efficient barrier shutting off the disease from these valleys the high altitude must be a factor preventing its occurrence."

Quarantine in Barbados.

244. In growing cocoa seeds in quarantine in Barbados, a number of difficulties were encountered which are worth reporting for the benefit of such work should it occur again.

245. The soil in the site chosen was a marl with about 6 inches of black sticky topsoil. The first beds made to receive the seedlings were forked thoroughly and the seedlings, already germinated in leaf mould in boxes, were carefully planted out at intervals of 8 to 12 inches. For a time they grew well but as soon as the roots reached the marl subsoil, violent chlorosis occurred and many of the plants, after becoming yellow, ceased to grow and a few died.

246. In order to save them, they were lifted and potted into bamboo pots filled with a special compost consisting of 4/5 pen manure and sand and 1/5 soil. This treatment failed to save all the chlorotic plants but many recovered.

247. Growth in bamboo pots however, is never satisfactory if the plants have to be kept for periods exceeding 6 months and when a large consignment of seeds arrived the nurseryman decided to plant them in beds prepared by scraping more soil together and incorporating humus and sand to make a compost depth of 12 inches.

248. Shade conditions allowing 50 per cent. of direct sunlight were found to be quite suitable and when the sides of the nursery were provided with sacking to break the wind, the seedlings grew well both in pots and in the prepared beds.

249. Then came the abnormal wet season of 1938 when exceptionally heavy rainfalls were experienced. After a short time the seedlings both in pots and beds began to die, those in pots faring much worse than the ones in beds. Several thousands were lost in this way. The trouble was found to be much worse in areas where surface water from outside seeped into the nursery and kept the beds waterlogged for long periods at a time.

250. The bulk of plants in pots which died were literally drowned owing to the hole at the base getting plugged with mud caused by the pots standing directly on the soft and sticky soil.

251. When the rains ceased the dying ceased. Sickly plants however, were slow in recovering and so they were transplanted into new compost in large clay pots or tins. Recovery then was more rapid.

252. Some interesting observations were made on lime tolerance among the seedlings. Many in the beds, even after being well made up, became chlorotic when the roots reached the marl but an appreciable percentage suffered no chlorosis and grew at a phenomenal rate. At the age of 8 months quite a number of these seedlings were standing 8 feet high with a jorquette. Such growth is very unusual among cocoa seedlings of the present Trinidad population.

253. Some little difficulty was experienced in cutting budwood at the correct stage of maturity. Routine budding in Trinidad is performed with fan buds from which the subtending leaf has recently abscissed, but such buds taken from young seedlings were found to be immature and the percentage of successful buddings was often very low.

254. This was changed when the buds were left six months longer to mature and it appeared that this maturing was aided by decapitating the seedling and allowing more light to strike the stem.

255. Then a peculiar budding result was noticed, namely, that either the majority of or only a few of the buds from one seedling were successful even using mature buds, a reaction which suggests stock-scion incompatibility. In most cases where only one bud was successful it failed to make good growth.

256. The stocks to receive the buds were all grown in large bamboo pots but they gave similar trouble to that experienced before and at the stage required for budding, when they should be in good health and showing vigorous growth, the reverse usually was the case.

257. A small number of stocks grown in larger containers gave much better success, showing that much of the failure in budding is due to unhealthy stocks.

258. However, in rainy weather budding cannot be performed in the field and it is only practicable for budding under cover, to grow stocks in bamboo or other containers.

259. Some 850 varieties, each represented by two specimens were transplanted to the testing nurseries at Marper before the end of the year without a single loss. No further plantings will be made until the rains come in May or June of 1939. Beds have been prepared to receive the remainder, together with a number of local selections. The surplus plants were distributed free to planters who undertook to watch them for witchbroom incidence.

G.—MISCELLANEOUS.

1. *Budded Cocoa.*

260. During the year a number of trial blocks of budded cocoa, produced from very high yielding and self-compatible parents, were planted and provision is being made for an extension in the number of these plots during 1939.

261. Budded cocoa is not new to the Colony. Between 1914 and 1921 several hundreds of budded progeny were produced. The majority of these were planted as experiments at River Estate and a few were issued to planters.

262. No attempt was made by planters to give these budded trees a fair trial, and since they were low-budded with fan buds they were discredited on account of their low branching habit.

263. Research work has shown that there are very great possibilities of yield increases in cocoa provided the few highly desirable parents, now located, can be propagated by vegetative means, since seedling progeny do not inherit the characters of the parents.

264. To realise these yield potentialities either budded plants or rooted cuttings must be employed. The parents must be guaranteed inherent high yielding trees otherwise the budded progeny will not be high yielding.

265. The low branching habit has now become recognised as being much more efficient than the tall tree, driven upward by faulty methods of pruning. On 18 year-old budded trees at River Estate practically all the pods can still be reaped with a cutlass and it is not difficult to see witchbroom infection on the tips of the topmost branches.

266. Yields of 1,000 to 1,500 lb. of dried beans per acre per annum have been obtained from a block of budded progeny and with more recent selections, individual trees at the age of 3 to 4 years have given 3 to 4 lb. of cocoa in chocolate soil when the trees were well looked after.

267. It is perfectly easy to give budded cocoa trees orchard cultivation and train them to produce symmetrical growth and a well balanced head. Care must always be taken to prevent the growth of chupons from the stocks.

268. The plots which are being planted in different parts of the colony are to provide a nucleus of material from which budwood can be taken at some future date to extend the plots. It is much easier and cheaper to produce progeny-budded at stake actually on the estate than to produce them budded at a central nursery in bamboo or other pots.

269. It may prove possible to effect conversion of some of the existing cocoa by budding on to chupons from the old tree. A planter in Tobago has made good progress with this method in converting his forastero trees to criollos.

2. *High yielding Tonka Beans.*

270. When a three acre plot of tonka beans was planted at River Estate in 1935, seeds were taken from trees which had been recorded as cropping each year for a period of three years. The seedlings were well planted and well cared for and they produced record growth in the first year. About 30 produced flowers at the end of the first year and those which were allowed to crop, matured about 6-pods each in April, 1937. These trees *all* bore crop again in 1938 and some of them are carrying more than 100 fruit for the 1939 crop.

271. Compared with the island average of half a dozen pods expected from a six to ten year old tree these yields are phenomenal.

272. There is a chance that the individual trees which have given three crops before they were four years old have inherited some character for earliness of bearing and possibly heavy and continuous bearing. If so, they should be the standard to which tonka bean growers must work. Speculation on prices three years after planting is much less of a gamble than speculation on prices ten years or more ahead.

273. In 1938 tonka bean stocks were planted in one of the poor cocoa fields which will be budded with scions from these 30 young trees to test whether this earliness of heavy bearing is transmitted. If it proves to be so, then a rapid multiplication of these trees will be possible.

3. *Salt Water Paddy.*

274. In 1937, while emergency irrigation measures were being put in over some of the rice growing areas, it was learned that much of the water which could be most easily used for irrigation was brackish and would ruin the growing rice.

275. A brief survey showed that some two-three thousand acres of land could be used for rice in the Bejucal area alone if varieties resistant to brackish water could be obtained. At the same time it would make irrigation much more easy.

276. Inquiries were sent through the Imperial Institute for varieties of salt water paddy and some 30 to 40 reputed varieties were obtained. Samples of those which arrived before the planting season of 1938 were planted out but the abnormal floods destroyed them with much of the remainder of the rice in the area chosen.

277. In 1939 a much more comprehensive planting involving all the varieties received will be made.

4. *A local Fibre Industry.*

278. Renewed interest, in establishing a local fibre industry as an alternative to sugar cane extension by peasant proprietors, was shown in 1938 and retting trials of *Urena lobata* were made. Hand prepared samples of the fibre were submitted to England and America for reports, and in both cases the replies classed the fibre as good and equal to jute fibre.

279. From Madagascar, India and West Africa there are small exports of the fibre from *Urena lobata*. In Brazil there is a local industry which uses *U. lobata* fibre mixed with imported jute fibre for making coffee and cocoa sacks. Formerly, there was an industry in Cuba, but that seems to have ceased through the high cost of labour.

280. Details have been worked out of the probable costs of production of this fibre in Trinidad. If the estimates of crop, as judged from yields of natural stands of *U. lobata*, are at all accurate when applied to large scale plantings, then the cost of production can hardly be less than 5 cents per lb. when the present market value f.o.b. Port-of-Spain is 2½ cents. There are however, possibilities of larger yields from cultivated plots, of cheaper production by peasant industry and also possibilities of utilising the fibre locally for sacks.

281. It is anticipated that trial plots will be planted in 1939.

F. J. POUND,
Agronomist.

REPORT OF THE MANAGER, RIVER ESTATE FOR 1938.

The year 1938 was unusual in two major respects, viz.: the complete and persistent slump in prices of all agricultural produce and the altogether abnormal weather conditions.

2. Crops generally were good except in the case of limes, which crop was nearly 75 per cent. short of the 1937 output. Grapefruit, coffee and tonka beans all yielded in excess of any previous year while cacao and oranges were well up to standard yields.

3. The rainfall for the year amounted to 87.15 inches and there was unusual flooding during the latter part of the year, as a result of which, rather extensive damage was caused to the retaining wall between the river bank and the estate yard. It will be necessary to repair this damage at some considerable cost before the advent of the next wet season. A good deal of damage was also done to roads, bridges, drains and young cultivations. There was no definite dry spell at any time of the year resulting in almost complete and continuous soil and atmospheric saturation, a condition which kept plant life in a state of continual hesitation, prevented a normal setting of fruit, hampered cultural operation considerably and added greatly to the cost of weed control.

Revenue and Expenditure.

Revenue.

4. The total revenue for the year amounted to $16,182.35. Of this amount, the sum of $10,024.79 was derived from cacao and $6,157.56 from subsidiary crops and pasture fees. Deferred deposit funds with the Cocoa Planters' Association now amount to $2,302.73 and Scrip Certificates from the Citrus Growers Association total $1,714.18 to date. Selected cacao pods to the value of $295.80 were supplied free of charge to St. Augustine Nursery and for shipment to the United Kingdom for exhibition purposes. While these latter items bring no revenue to the estate, they entail unusual expenditure inasmuch as the pods are all carefully selected and when picked for shipment have to be specially treated and packed. This is just but one instance of the numerous demands made upon River Estate.

Expenditure.

5. The total expenditure amounted to $27,841.93 plus a sum of $2,300.00 granted by the Cocoa Subsidy Board. Maintenance of subsidiary crops, experimental work, public services, timber plantations and capital expenditure together amounted to $8,776.79 of the total expenditure.

6. This apparently heavy expenditure is due primarily to the extension of cultivated areas, increasing experimental work and labour costs.

7. The number of crops being dealt with, the continuously increasing experimental work and the requests for public services not only add much to the general activities and value of River Estate but swell the expenditure columns. Such, however, is the proper function of all large scale experimental and research work, but with the limited staff and the diversified work, adequate supervision becomes increasingly difficult.

Cacao.

8. The cacao crop amounted to 1,077 bags of 165 lb. each as against 1,011 bags in 1937 and 1,021 bags in 1936. Besides this the equivalent of nine bags was supplied in pods to St. Augustine Nursery for propagation and to various other parties for exhibition purposes. The average price as obtained from the Cocoa Planters' Association was 4.7 cents per lb. for grade cocoa as against 11¼ cents per lb. obtained in 1937.

9. Considering that the area under cacao is being steadily reduced the crop may be regarded as very satisfactory, working out with an average over-all yield of 2.6 bags per acre.

10. Pure cacao stands (326.3 acres) averaged 3.0 bags per acre and interplanted areas (77.4 acres) 1.2 bags per acre. All routine work was carefully attended to, special attention being paid to removal of witchbroom, pruning, draining and roundridging. Pen manure was broadcast and forked in on the bad areas along the roadsides of fields Nos. 6B and C, 20A and 23A and ground shade planted. These areas now show a marked improvement as a direct result of this treatment.

Cacao Subsidy.

11. A sum of $2,300.00 was expended under this head and allocated as follows:—

Cacao Rehabilitation	$1,744 00
Interplanting auxiliary crops	400 00
Replacement of cacao	156 00
	$2,300 00

12. The bulk of the expenditure under "A. Cacao Rehabilitation" was confined to trenching with pen manure, broadcasting pen manure and forking in, draining and round-ridging. Pen manure was broadcast and forked in along the entire western half of field No. 11 while the other or eastern half was trenched with pen manure in the usual manner. The whole of No. 10A and B was also trenched with pen manure. The four old distance planting plots, *i.e.* the 12 ft. by 12 ft., 14 ft. by 14 ft., 16 ft. by 16 ft. and 18 ft. by 18 ft., all received a surface dressing of pen manure which was forked in. In all cases manure was applied at the rate of approximately 16 tons to the acre.

13. The following fields were drained and roundridged: Nos. 2A (portion west of river), 6A, 6B, 6C, 8B and 8C, 10B, 18A (old distance plots), 22B and 22C and 23A. Cacao supplies were depth weeded and mulched at regular intervals.

14. The interplanting of Nos. 1B and 1C and 17A was completed, No. 1C being interplanted with Valencia oranges. Heavy pruning of the cacao trees in Nos. 12B and 17A was carried out to give room to the fast developing tonka bean and coffee trees and all young interplanted crops were kept free from weeds. No. 18B which was the first field to be interplanted with subsidiary crops at River Estate, viz.: coffee and tonka beans, is progressing favourably and most of the coffee trees are now in bearing.

Replacement of Cacao.

15. Approximately 1⅛ acres of No. 18A north of the young distance plots was cut out and replanted with King oranges, roughly 4 acres of No. 15 was completely cleared, drained, roundridged and planted with Zapucaia nuts with plantain and gros michel bananas as a catch crop. Nos. 20C and 20D which were cleared of cacao in 1937 and have since been replanted with Marsh grapefruit and I.C.S. cocoa buds and cuttings respectively are doing moderately well. Cacao beetles and witchbroom disease are however proving a serious menace to the latter. The small plot of King oranges in No. 20B was well maintained and is progressing favourably. Cacao subsidy funds have again played a part in affording regular employment to labour.

Diseases and Pests.

16. Diseases and pests of cacao were much in evidence throughout the year. Weather conditions favoured most of these and witchbroom disease continues its spread with pod infection showing some increase over previous years. Cacao beetles caused much damage to young cultivations, especially where they occur in combination with leaf cutting beetles and thrips which latter pests were particularly active towards the end of the year. The fight against diseases, pests, deteriorating soil fertility and other adverse conditions is ever an unrelenting one which can only be appreciated to the full by those in close and daily contact with the growing crop. The fact that cacao as a plant can and does survive from its earliest stages to final maturity despite these persistent difficulties is a clear indication of its natural hardihood. Its survival is difficult today with the accumulation of pests and diseases, ageing trees and soil deterioration. Herein lies the fundamental difference between cacao planting 30 or 40 years ago and today.

Grapefruit and Oranges.

17. These crops were particularly good but prices obtained through the Citrus Growers' Association were again most disappointing.

18. The following is a resume of the crop :—

Grapefruit :		
4,913 crates shipped to packers realized	$1,970 03	
Out of which an advance was paid of	1,261 55	
Seeded and culled fruit sold locally	280 21	$1,541 76
Oranges :		
297 crates shipped to packers realized	159 06	
Navels, King and Cocoa oranges sold locally	657 14	816 20
Shaddocks sold locally realized		12 85
		$2,370 81

19. Usual routine work was attended to and a fertilizer mixture consisting of three parts of superphosphate, two parts sulphate of potash and one part sulphate of ammonia was applied throughout at the rate of 3 lb. per tree. Gummosis disease accounted for a number of deaths among the older and low-budded trees, but most of these have since been supplied. Citrus scab disease again very seriously affected the King orange plot and also attacked many grapefruit trees. This disease was of course largely influenced by the particularly wet and humid conditions which prevailed but it is interesting to note that its incidence has already perceptibly declined with the advent of the drier months. As a result of weather conditions, the grapefruit crop for the season 1938-1939 must be regarded as negligible.

Mangoes.

20. In view of the uneconomic value of this plot due to its unsuitable environment, its substitution by some other crop plant has been under consideration for some years but no decision has as yet been arrived at. It is possible that cloves might prove a useful and interesting substitute. The 1938 crop was a complete failure and not a single fruit was obtained.

Limes.

21. The lime crop was a particular victim of the weather and amounted to a mere 511 barrels of 160 lb. each as against 2,009 barrels reaped in 1937, nearly a 75 per cent. shortage. All lime fields received three cutlassings during the year, a large number of contour drains were put in and the whole of the older field pruned and freed of bird vine.

22. All lime trees (except T.1 under experiment treatment) received similar fertilizer treatment as the grapefruit and oranges and at the same rate per tree. The T.1 limes in field No. 24 are making fair growth but there is little or no demand for the fruit. Only one contract was taken over during the year.

Tonka Beans.

23. This crop was a record one and was disposed of as follows :—

	lb.	
Beans sold to Coconut Growers (as per contract)	964¼	$1,314 27
20,150 pods for plants sold to planters	111¾	181 80
12,950 pods for plants (River Estate and contracts)	72	
	1,148	1,496 07
200 plants sold at 1c. each		2 00
		$1,498 07

24. Extension of the area under this crop has been proceeding rapidly and there is to-day not less than 120 acres under cultivation, 80 acres by the estate and 40 acres in the hands of 13 contractors. River Estate soil is particularly adaptable to the growth of Tonka Beans and should prices hold future prospects will certainly be promising.

Coffee.

25. Coffee (all Robusta) also was a record crop and amounted to a total of 8,714 lb. which realized a sum of $406.75 at an average price of 4.6c. per lb. Robusta coffee has proved a useful inter-crop plant as it helps to cover the ground quickly and crops early. When they finally become too woody and unproductive the old plants become an excellent source of supply for stakes, being straight and durable.

Timber.

26. This section continues to progress as well as can be reasonably expected under the circumstances. While a fair amount of control work has been done by way of cutlassing, thinning, maintenance of roads and opening up of new roads, time and staff have not permitted of any definite or set policy on an organized basis. During the year three more contracts containing approximately 2,356 trees were taken over.

Miscellaneous Crops and odd corners.

27. Gros Michel bananas and plantains have been planted on many sections of the estate as temporary shade for permanent crops. Banana sales realized a sum of $380.54.

28. The budded avocado pear plot was extended and now comprises some 75 trees which are making healthy growth. A 4-acre plot of Zapucaia nut was laid down in field No. 15 towards the end of the year. The Derris plot in field No. 1C continues to make rapid and vigorous growth and the roots are about ready for digging. The small plots of clove, pimento and Langsaat (*Lansium domesticum*) are making fair growth.

Experimental Work.

29. The details of this work which continues to increase from month to month are dealt with by the Agronomist in his report. It may be of interest to note here that there are some 30,000 cacao trees over an area of approximately 100 acres under various experimental treatment at River Estate. There are also experimental plots with tonka beans, coffee and limes from all of which crop records have to be kept and the various treatments carefully attended to. The I.C.T.A. cacao experiments in field No. 7B (selections propagated by cuttings and buds) were further extended during the year and now occupy the whole of this field. Progress of this plot has been somewhat retarded by falling immortel trees and cacao beetles

30. The variety trial plots in field No. 19 continue to make satisfactory growth despite a fairly heavy infestation of witchbroom and are now yielding a moderate crop. Most of the remaining cacao trees around this 12-acre block were cut out and the area replanted with budded criollo cacao.

31. The 4-acre coffee variety trial plot in field No. 23 is getting on very slowly owing to insufficiency of shade and unadaptable soil.

32. During the year a fairly large scale experiment was made with the retting of cousin mahoe for fibre extraction. About 170 lb. of this raw fibre was obtained which has been fairly favourably reported upon abroad.

Stock.

33. The stock at the end of the year comprised : 4 mules, 5 horses, 4 cows, 3 heifers, 2 calves and a pure bred Holstein bull. The services of this bull are in constant demand and should be supplemented by a second animal. Two of the mules will have to be replaced owing to age.

Motor Lorry.

34. The motor lorry was kept busy throughout the year taking in produce and bringing out manure and materials from Port-of-Spain.

Yard, Buildings, Roads, &c.

35. General sanitation of the yard and buildings was well maintained. The Public Works Department completed the painting of the labourers' barracks and certain improvements to the Manager's quarters.

36. All roads were well maintained and four new concrete culverts were constructed as also re-inforced concrete roofing over the reservoir. This roof has been so contrived as to permit of the easy entry of persons for occasional cleaning of the reservoir and of sufficient sunlight. Formerly the water service was frequently interrupted by flooding during the wet season. This defect has now been obviated.

Visitors.

37. Visitors were numerous during the year. Formal visits were paid by the staff and students of the Imperial College on the 2nd February, a party of agriculturists from the Chaguanas District on the 24th February, and the Ecclesville District Agricultural Society on the 22nd October. Parties from the Government Training College and other schools visited at various times.

Staff.

38. In conclusion I have to report satisfactorily on the work of all members of the staff.

39. The usual statements are attached.

RODERICK O'CONNOR,
Manager, River Estate.

RIVER ESTATE.

Statement of Revenue and Expenditure for the year ended 31st December, 1938.

Particulars.		Revenue.	Particulars.	Expenditure.
	$ c.	$ c.		$ c.
By sale of :—			Personal Emoluments	6,348 00
Cacao (Manufactured)	10,003 04		76—Maintenance	14,770 78
Cacao Pods	21 75	10,024 79	77—Travelling and Transport ...	1,002 60
Grapefruit	1,541 76		78—Incidentals	299 08
Oranges	816 20		79—Timber Contracts	937 91
Shaddocks	12 85	2,370 81	80—Improvements	1,792 03
Limes		995 47	81—Fertilisers	496 92
Tonka Beans		1,498 07	82—Materials	590 87
Coffee		406 75	83—Stock (Feed for)	746 39
Pasture and Service Fees ...		180 76	84—New Cacao Variety Trial ...	797 35
Miscellaneous :—			85—Entertainment of Visitors ...	60 00
Firewood, Provisions, &c. ...		325 16	*Cacao Subsidy* :—	
			Expenditure ...$2,300 00	
Bananas		380 54		
		16,182 35		27,841 93

RIVER ESTATE.

Rainfall for the year ended 31st December, 1938.

Date.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Grand Total.
1	...	.17	...	...	...	...	.14	.12	.18	.94	.75	...	
2	.34	.15	.15	...	...	...	...	.15	...	...	...	...	
3	.24	.71	.12	...	...	.25	...	1.65	.02	...	1.20	.08	
4	1.86	...	1.16	...	...	...	70	...	.64	...	.10	.20	
5	.25	...	...	...	.40	...	...	...	...	...	...	.68	
6	...	.35	.95	...	.20	.19	.42	...	.17	.18	.72	.25	
7	...	.41	...	.47	...	.48	...	...	...	...	.42	...	
8	.47	.46	.21	.11	.62	.09	...	1.66	...	...	.56	.45	
9	.14	...	.72	...	...	...	1.00	...	.09	.62	1.62	...	
10	...	.05	...	...	...	.10	.09	.95	.16	...	1.90	.38	
11	...	...	...	...	...	.67	...	.55	...	.14	.05	...	
12	.30	.18	...	...	...	1.03	...	...	...	...	...	.04	
13	...	.40	.28	...	...	.47	1.40	1.10	...	...	1.36	...	
14	.20	...	.15	...	.70	...	.20	.17	.43	...	...	.33	
15	.48	...	...	...	...	...	...	...	...	.35	.06	...	
16	.35	...	...	...	...	.10	...	...	...	...	...	.40	
17	.07	.55	.10	...	...	...	.42	.40	...	...	1.54	.47	
18	...	...	...	...	.17	...	...	.45	.46	...	.06	.23	
19	.04	...	...	.58	.46	...	...	.19	...	...	...	.28	
20	.35	.24	...	.50	.31	...	.90	...	...	.54	...	.06	
21	...	...	...	.07	...	...	1.80	...	.10	.78	.64	...	
22	.13	...	.45	.46	.60	.22	.20	...	...	.06	.90	.77	
23	.46	...	...	.07	...	...	.12	.45	...	.50	1.78	...	
24	.14	...	...	.04	.15	...	.68	...	.81	.70	.40	.43	
25	.04	...	.32	...	.10	...	...	1.03	...	1.78	.30	.16	
26	.09	...	.70	...	1.06	.24	.70	...	...	...	.10	.24	
27	...	...	.14	...	...	...	2.16	.76	.52	...	.05	.15	
28	...	...	...	.65	.09	...	1.65	.52	1.70	.45	...	.06	
29	.07	...	...	...	.12	.10	.65	...	...	...	...	...	
30	.60	...	.11	...	...	1.18	.10	...	.88	...	.40	...	
31	.05	...	.12	...	.70	...	...	...	...	.10	...	.03	
Total	6.67	3.67	5.68	2.95	5.68	5.12	13.33	10.15	6.16	7.14	14.91	5.69	87.15

REPORT OF THE MANAGER, ST. AUGUSTINE NURSERY AND EXPERIMENT STATION, 1938.

In April Mr. E. J. Gregory, Manager of the Experiment Station, was appointed to a post in Uganda from when I was instructed to act as Manager in conjunction with my substantive post as Manager of the Nursery.

2. I should like to place on record the help given to me by Mr. A. E. Joseph, Chief Field Assistant of the Nursery and Experiment Station, and Mr. A. A. Brunton, Field Assistant of the Nursery whose duties were increased owing to the receiving and recording of the cocoa budwood from Barbados.

ST. AUGUSTINE NURSERY.

Plant Distribution.

3. The total number of plants distributed in 1938 showed a decrease of 63,193 from 1937; of this amount, cocoa seedlings were reduced by 61,075 under the Cocoa Subsidy Board's orders. The total number of plants distributed were 269,900 in 1937 and 206,707 in 1938.

4. Decorative plants distributed in 1938 have again shown an increase being 3,998 over 1937, the total number distributed being 16,000 in 1937 and 19,998 in 1938.

5. The number of plants distributed free to Government institutions has again risen, being 4,153 more than in 1937; the total amounts were 11,932 in 1937 and 16,085 in 1938. In addition to this, 133 boxes of seedling annuals were issued.

6. The demand for seedling annuals in boxes, viz.: Antirrhinum, Petunias, Phlox, Verbenas, Zinnias, Vincas, Browalia, Salvia, Pentas carnea, Portulaca, Marigolds, has increased and become popular to such an extent that the public is more and more relying on this method of keeping their flower beds supplied. The number of boxes distributed yearly since the commencement is as follows:—

1936	139 boxes.
1937	508 do.
1938	1,450 do.

7. The following is a detailed list of plants, seeds, cuttings, &c., distributed:—

Budded Citrus.			
Grapefruit (Marsh)	4,156		
Do. (assorted)	502	4,658	
Oranges and other citrus		6,270	
T. 1 Limes		126	11,054
Other Budded and Grafted Plants.			
Mangoes		2,212	
Avocados		1,901	
Cocoa		7,009	11,122
Seedlings.			
Limes, West Indian			6,084
Cocoa			149,797
Coffee			16
Miscellaneous Fruit Plants			2,696
Other Economic Plants			959
Timber and Decorative Trees			4,981
Decorative Plants			19,998
Total number of plants distributed			206,707
Seedling Annuals in boxes		(boxes)	1,450
Cuttings.			
173 cuttings and 2 bundles.			
Budwood (No. of Buds).			
Citrus buds		19,847	
Mango buds		150	
Avocado buds		350	20,347
Seeds.			
Countable			5,250
Weight (lb).			3½
Miscellaneous (packets)			97
Produce.			
Limes (lb.)			2,377
Grapefruit			650
Oranges			3,186
Avocados			2,736
Other Miscellaneous Fruit			2,096
Bananas (bunches)			37
Vegetables (lb.)			50
Miscellaneous.			
Prepared tape (yds.)			1,527
Leaf mould (bags)			178
Bamboo pots			36
Clay pots			190

Revenue.

8. There was a drop in revenue of $1,377.88 from the previous year: this was accounted for by the decreased number of cocoa plants distributed under the Cocoa Subsidy Board.

	Heads.	$	c.
Grapefruit plants	... ...	1,361	74
Other Budded and Grafted Plants	... ...	1,759	73
Other Economic Plants	... ...	4,009	99
Decorative Plants	... ...	2,155	33
Produce	... ...	129	66
Miscellaneous	... ...	413	66
		$9,830	11

Citrus.

9. The demand for Marsh Grapefruit plants continues but owing to the abnormal season experienced in 1937, less stocks were available for budding and only 4,156 were distributed as against 7,505 in 1937. Oranges and other budded citrus plants dropped from 8,728 in 1937 to 6,270 in 1938.

10. Seedlings of the West Indian limes distributed were 6,084 as against 10, 730 in 1937.

Cocoa.

11. Cocoa seedlings were grown and distributed under the Cocoa Subsidy Board to the amount of 149,797 and another 50,000 were grown to be used as stocks for budding. Budwood was received from Barbados and also from local trees selected for their partial resistance to Witchbroom; the plants produced are to be planted out at Marper Estate for observation. Budded plants have been raised from trees selected for their compatibility and distributed to estates in the best cocoa growing districts. The total amount of budded cocoa plants distributed was 7,009.

Avocados.

12. The number was increased in 1938 by 542, the total amounts being 1,359 in 1937 and 1,901 in 1938. Pollock and Rudder are the two varieties in greatest demand.

13. An introduction of several Florida varieties was attempted by budwood packed in thermos flasks and sent by air mail but none survived the journey.

Mangoes.

14. The sales of grafted mango plants continue to increase and 2,212 were distributed in 1938 as against 1,359 in 1937, the variety Julie being the greatest in demand.

Weather.

15. Rain fell throughout the year and 79.25 inches were recorded as against 55.72 inches in 1937. There was no pronounced dry season. The economic and decorative plants did not develop as they usually do, and our extensive seed beds of sour orange seedlings in the open were killed by a damping off fungus, but a fine lot was grown later under shelter.

ORCHARD PLOTS PLANTED FOR PROPAGATING MATERIAL IN 1938.

Avocados.

16. The following varieties are growing in this plot:—

Local:—St. Ann's, St. Clair and River.

Introduced:—Pollock, Rudder, Simmonds, Panchoi, Butler, Dunedin, Collinson and Winslowson.

Mangoes.

17. The varieties in this plot have all been maintained but owing to the absence of a dry period very little fruit was set, the trees not flowering normally.

18. The following varieties are now established from which grafted plants are grown annually:—

Julie, Peter, Gordon, Peach, Graham, Blacknam, Rouseau, Zabricot, Bombay, Sandersha, Dora Barbadensis, Divine, Buxton Spice, Mrs. Dare, Ceylon and (St. Lucia) Pere Louis.

Citrus.

19. In this collection are the following from which budwood is available for propagation in our own nurseries and for sale to persons who grow their own stocks:—

Orange:—Parson Brown, Jaffa, Valencia, Navel, Lue Gim Gong, St. Michael's, St. Michael's Blood, Pineapple, Majorca, Lamb's Summer, Sandford's Mediterranean, Ruby, Homosassa, Cocoa orange and Seville.

Portugals and Tangerines:—King, Dancy, Satsuma, Cleopatra and Grenadine.

Tangeloes:—Sunrise, New, Sampson, William and Tangelolo.

Lemon:—Perrine, Meyers Chinese, Sicily and Ponderosa.

Limes:—West Indian, Spineless, Everglade and Kutzi Nimbu.

Grape Vines.

20. These have developed and plants have been raised and distributed to those interested in the growing of this fruit.

General.

Budwood.

21. The variety, "Cecily Grapefruit", a sport of the Walter, imported from South Africa in August, 1936, was released after two generations in the Plant Quarantine Station and plants are now growing in the nursery.

Lonchocarpus.

22. Introduction of the black and white Haiari from British Guiana flowered during the year and specimens were sent to Kew and identified as *Lonchocarpus chrysophyllus* and *Lonchocarpus martynii* respectively. These species are low in rotenone contents.

Aleurites (Tung oil).

23. The variety Montana planted in 1931 has grown well but did not produce any seed pods for the year.

Flowering and decorative plants.

24. Hibiscus plants as standards are now being distributed. The stock used is a strong growing single variety and when grown to the required height buds of the double and the choicer single variety are put on.

25. The following decorative plants have been added to our collection :—

Lantana sellowiana, Lantana flava, Senecio confusus, a variegated leaved form of the Mrs. Butt Bougainvillea, *Browallia Viscosa, Compacta Sappheri* and the water plants, *Nimphaea* and *Nelumbium* which developed well and since commenced blooming have daily given flowers of pink and blue shades.

Buildings.

26. Two additional shelters have been erected for the growing of seedlings ; these are covered with alternate lengths of plain galvanized iron 2 ft. wide and two runs of glass 1 ft. wide. Nine concrete tanks have been built to grow the plants of Nimphaea and Nelumbium, and also two span roof shelters were erected to be used for the budding of cocoa during the rainy season.

Educational Visits.

27. The Principal, Professors and Students of the Imperial College of Tropical Agriculture ; Mr. M. E. Basanta with the pupils of the C.M. School of Guaico, Sangre Grande ; the Head Teacher and pupils of the Caroni C.M. School ; and the Head Teacher, Mr. H. Manuel, and pupils of the Bien Venue C.M. School, San Fernando.

Donors of Plants and Seeds.

28. Lieut. Col. Wilson ; the Director of Kew Gardens, England ; Messrs. Vilmorin Andrieux & Co., France ; and Messrs. J. L. Agostini, Claud Green and S. C. Lawrence.

ST. AUGUSTINE EXPERIMENT STATION.

Rainfall.

29. The rainfall for the year was above 1937 by 23.53 inches and the monthly reading from the Government Farm is as follows :—

Months.	1937	1938
	Ins.	*Ins.*
January	5.05	2.60
February	.89	1.20
March	.40	3.64
April	2.44	4.91
May	.19	7.74
June	6.56	4.38
July	4.96	8.45
August	6.21	12.59
September	4.00	7.21
October	6.59	5.62
November	11.44	12.71
December	6.99	8.20
Total	55.72	79.25

30. The first part of the year was wet and the damage done by scale insects was negligible.

31. In the latter part of the year an outbreak of Gummosis appeared.

Citrus Experimental Block.

32. Since the laying out of the Experiments in 1931 the general manurial treatments have been modified from time to time. During the year pen manure alone has been applied throughout the citrus block to be followed by fertilizer treatments which will be rearranged in 1939. No trimming of branches was done for the year.

Cultivation.

33. Additional cutlassing was necessary owing to the vigorous growth of grass throughout the year. The trees were roundeared after each cutlassing but no draining or weeding was carried out.

Windbreak.

34. Belts of *Tephrosia Candida* were maintained throughout the experimental area but it would seem that the protection was too dense owing to the abnormal rains and may have been favourable to the development of Gummosis.

Crop.

35. Approximately 3,000 crates of grapefruit and 250 crates of oranges were sent to the Packing House showing increases respectively of 2,500 crates and 190 crates over 1937. The revenue realized was $715.18.

Limes.

36. Back crosses of T.1, T.6, and T.145 with the West Indian, and crosses between Spineless West Indian and Everglade with the West Indian lime were again attempted. Due to heavy rains during the flowering period a great quantity of the pollinated flowers dropped ; however, a small amount of seed from each of these crosses was obtained and sown in boxes towards the end of the year.

37. Of the seedlings raised from the 1937 crosses, 76 have been planted out and have made fair growth. The 1936 crosses planted in 1937 are not yet fit for selection by field characters, as this work cannot be carried out satisfactorily before they come into bearing.

38. In Field 16, the 1933 back crosses have been replaced by about 200 Tahiti and 150 T.145 budded lime plants so as to provide material for trial shipments of green limes. The remaining portion of this field has been planted up with Perrine lemon on different root stocks for observation.

Sugar-Cane.

Multiplication and Distribution of New Varieties.

39. The following ten varieties were distributed to estates for trial under estate conditions :—
B. 34104, B. 34117, B. 34163, Co. 313, Co. 419, Co. 421, C.P. 28-11, C.P. 28-19, N.G. 251 and F. 31/248.

40. Further supplies were made of the cane varieties sent out in 1937, to be tried out on a larger scale in variety plots on estates.

41. Nineteen new varieties were released from the Quarantine Station for multiplication at St. Augustine :—
B. 3215, B. 3254, B. 3267, B. 3307, B. 3337, B. 34110, B. 34123, B. 25151, B. 35197, B. 35200, B. 35204, B. 35207, B. 35247, Co. 299, Co. 331, Co. 352, Co. 360, Co. 413, Co. 432.

Cane Crop.

42. One hundred and eleven tons of cane were reaped and delivered at the Curepe siding for the Orange Grove Estates. The crop realized $288.86.

Avocados.

43. A plot was laid out with varieties selected by Dr. Wardlaw for cold storage tests overseas comprising the following :—
Macqueripe No. 2, St. Joseph No. 1, St. Joseph No. 2, St. Joseph No. 3 and Lenegan.

44. A further plot was also laid out with introduced varieties for trial :—

Hybrids	...	...Winslowson and Collinson.
West Indian	...	...Butler and Simmonds.
Guatemalan	...	...Panchoi.
		Dunedin.

Minor Crops.

Pigeon Peas.

45. The two types of local peas, Lasiba and Tobago, have been grown and seeds were distributed to peasant proprietors.

46. The pigeon peas introduced in 1937 were planted and grown on a larger scale for comparison of yields and field characters.

Maize.

47. The three samples originally obtained from the Imperial College of Tropical Agriculture have been grown for mass selection and further trials.

Cover Crops.

48. Small plots of available cover crops were planted to keep up a supply of seeds.

Other Trials.

49. The following trial plots were laid out and reported upon : Sunflower, Fibre plants and Moon influence on Corn and Cassava.

General.

Buildings.

50. A field pen was erected at the southern end of the Station in order to provide a larger supply of pen manure.

St. Augustine Rice Lands.

51. Applications for the rented rice lands were more than the area available for cultivation. The twenty-six tenants occupied 13 acres which comprise the rice lands under our control.

Weather.

52. Conditions were not at all good for the growing of minor crops rain hampering the work of sowing and weeding ; in most cases only small supplies of seeds were reaped.

Revenue, 1938.

	$	c.
Cane and cane plants	293	66
Grapefruit	413	46
Oranges	195	18
Miscellaneous	227	37
Total	$1,129	67

F. C. BUTHN,
Manager, St. Augustine Nursery and Experiment Station.

REPORT OF THE CURATOR, ROYAL BOTANIC GARDENS, 1938.

Royal Botanic Gardens, Government House Grounds, St. Clair, Queen's Park Savannah, Grounds of Government Buildings (Port-of-Spain), and Wrightson Road.

Royal Botanic Gardens.

Mr. J. H. Gomez was appointed as Overseer, Royal Botanic Gardens, and commenced his duties on 31st May, 1938.

2. In contrast to the low rainfall of 1937, the year under review was one of very heavy precipitation. A total of 90.48 inches was recorded at the St. Clair Station for the year and was the highest for the last half century. An exceptionally heavy rainfall of a short duration on 14th December caused serious flooding to the lower section of the Gardens, and several roads were seriously damaged.

3. The problem of erosion of the gravel surfaced roads in the Gardens was intensified during the year owing to the very inclement weather conditions. Resurfacing is now an urgent matter, and trials to determine the most satisfactory natural surface preparation are to be instituted at an early date.

4. Growth was good in the new areas planted with *Bougainvillea* during 1937. The original scheme of planting at the look-out Hill slopes, outlined in my report for 1937, was considerably extended; additional groups of *Bougainvillea Mrs. Butt* and *Bougainvillea Mrs. McLean*, were established together with an isolated colony of the unflowered hybrids raised at the St. Augustine Nursery. These groups show promise of providing the riot of colour which was an essential feature of the planting scheme. Savannah Grass (*Axonopus compressus*) has now completely covered the hillside and it is of interest to record the rapidity with which this grass has taken possession of the denuded lands.

5. Reversion of *Bougainvillea Mrs. McLean* to the type variety *Mrs. Butt* was of unusually frequent occurrence. Such examples of reversion to type, though somewhat uncommon, indicate the necessity for careful selection of propagating material.

6. Recent extensions of lawns which require to be regularly mown resulted in increased operation costs with hand mowers. A 36-in. mule drawn Pennsylvania Fairway Mower has been purchased to deal with this work and operates on all the principal lawns in the Royal Botanic Gardens, Government House Grounds, and North-West Sunken Corner, Queen's Park Savannah. This machine is extremely adaptable and can be used even on slopes and banks negotiable by the mule. Considerable economy from the use of this implement is anticipated and liberates the hand machines for work on areas which previously had to be cutlassed.

7. On 19th July, I visited Tobago in connection with improvements to the Botanic Station at Scarborough. Detailed recommendations with estimates were submitted in my report.

8. A feature of the work during the year under report was the discovery by experiment of the best methods of vegetative propagation of *Amherstia nobilis*, which is admittedly one of the most attractive of tropical flowering trees. The success which attended the method of 'wire constriction' to induce free flowering of *Medinella magnifica* was adopted, and excellent results have been obtained by selecting well ripened shoots approximately 2 feet in length and tightly constricting the flow of sap by means of a wire band. The layer was inserted into a bamboo pot and roots were visible after 2½ months. The shoot was in a suitable condition to be partially severed from the parent plant at the end of 4 months; final severance was possible a month later.

9. Two large specimen trees of *Tectona grandis* (Teak) due to their dangerous condition, and overcrowding of adjacent specimens, were felled and removed. It is probable that these trees were the first introductions in the Colony, and a conservative estimate would place their age at about 80 years. Several pieces were presented to the Conservator of Forests as specimens of interest for record.

10. As mentioned in my report for 1937, the condition of many of the older specimen trees give cause for alarm. Constant trimming and the removal of cases of "die back" was necessary to maintain them in a condition of reasonable safety. The last remaining specimen of *Picraena excelsa* (Bitter Wood) was considered unsafe and removed.

11. On account of the growing popularity of the Gardens, particularly amongst tourists, a notice board indicating items of interest was erected near the main gate, on which is displayed from time to time a list of plants of particular seasonal interest.

Government House Grounds.

12. In spite of the major alterations to the buildings and roads of Government House, it was possible to preserve the attractive appearance of this section.

13. A portion of the Front Flower Garden has been included in the Grounds of Government House; a hedge of *Flacourtia Ramontchii* and *Thunbergia grandiflora* has been planted against the fence. Large areas of abandoned roads and paths have been planted with grass, and alterations to the general layout of the grounds, including the newly acquired portion of the Royal Botanic Gardens, are being conducted.

14. For the greater part of the year maintenance of the ground was carried out by Prison labour supervised by the Curator, Royal Botanic Gardens; this form of labour was however replaced by daily paid gardeners under a foreman towards the close of the year.

Grounds to Government buildings, Port-of-Spain.

15. The programme of improvements to grounds of Government buildings in Port-of-Spain first commenced during the latter half of 1937 was completed at the close of the year under report. Improvements affected during that period are detailed below.

Auditor's Quarters.

16. The overgrown hedges on the western, southern boundaries were renovated and in some cases wholly replanted with *Aralia Guilfoylei*. The additional area now attached to these quarters has been enclosed by a high hedge.

Belmont Police Station.

17. A hedge of *Barleria cristata* was planted on the southern boundary, transported loam soil being provided as a suitable rooting medium. At the expressed wish of the Commissioner of Police fruit trees were supplied gratis, and planted around the precincts of the Station.

Colonial Hospital Grounds.

18. Attention was solely given to the area surrounding the new Wards. Portions of the main lawn damaged in consequence of the building operations were renovated, levelled and turfed. The grass plants surrounds constructed by the Public Works Department were filled with soil and planted with grass. A large area to the north of this building was taken in and converted to lawn.

Education Office.

19. A double hedge of *Caesalpinia pulcherrima* and *Murraya exotica* was planted on the eastern fence, the former plants being selected to provide an early screen to the unsightly galvanized iron fence. It is intended that the Barbados Pride plants be removed on establishment of the Murraya. Levelling of the existing lawn and relaying with turf was also undertaken. Decorative plants were supplied and planted in the ornamental section of the garden.

Excise Bond.

20. The waste grounds attached to this building were levelled and converted to lawns of Bermuda Grass (*Cynodon dactylon*); a total distance of 360 ft. of *Murraya exotica* hedges were planted. A neglected strip of land outside the boundary of the Excise Bond has been taken and maintained.

Girls' Industrial School.

21. The areas of uncultivated and very uneven land to the south of the building have been levelled with transported soil, drained, and laid down as lawns.

11, Mary Street.

22. General levelling and clearance of the areas to the back of the house was made and planted with Savannah grass. Renovation of the existing hedges on the eastern and northern boundaries have also been effected; a new hedge of *Murraya exotica* and *Caesalpinia pulcherrima* has been planted on the southern side.

Military Cemetery—St. James.

23. A scheme of improvement was submitted to the Commissioner of Police. These were approved and the following alterations were made. Extensive levelling of the ground was undertaken and planted with turf; a hedge of *Murraya exotica* on all four sides has been planted; ornamental group of Cabbage palms, Flamboyant Calliandra trees and Petrea arborea were arranged. A six-foot gravel pathway with grass walks leading away has subsequently been constructed.

Newtown Post Office.

24. The level of the existing land surrounding the building has been considerably raised to prevent flooding during the rainy season. This area has been turfed and hedges of *Malvaviscus arboreus* were planted on the western, eastern and southern boundaries.

St. James Barracks.

25. An avenue of variegated Hibiscus interspaced at 9 ft. apart with *Euphorbia pulcherrima* (Poinsettia) has been planted along the approach road to the Guard House.

St. James Police Station.

26. The existing lawns to the front of the Station have been levelled and replanted with grass. Renovations and renewals were made to the existing hedges; a complete new section along the road frontage has been planted with *Malvaviscus arboreus.*

South House.

27. The level of existing lawns have been raised, and replanted with Savannah grass.

Superintendent's Fire Brigade Quarters.

28. A new lawn with concrete steps leading from the house has been constructed. Complete renovations of the *Eranthemum Eldorado* hedges were also effected.

Sanitary Inspector's Quarters, Cocorite.

28. Neglected area surrounding the house has been levelled and replanted with grass; a hedge of *Malvaviscus* was planted either side of the entrance gate.

29. Regular attention has been given to grounds surrounding the Red House, Audit Office, Department of Agriculture, St. Clair, District Magistrate's Court, St. James Clinic and the Woodbrook New Health Office.

Planting Scheme—Reclaimed Area.

30. In consultation with the Town Planner, a scheme of planting of the traffic islands of the Reclaimed Area roads was prepared by this Department and adopted.

31. The scheme made provision for the planting of decorative flowering trees and shrubs of particular prominence during the Tourist Season, *i.e.*, January to April, and to create a reasonable impervious screen of trees and shrubs to obscure dazzle from headlights of approaching cars, cross-roads and at turning points between the traffic islands have been left unplanted so as not to obstruct the line of vision for drivers entering or leaving the main highways.

32. The treatment of the central reserves of the dual carriage-ways should be one of simplicity with ample stretches of grass and of irregular grouping of trees and shrubs as against a system of planting involving regimented lines.

33. The layout put into effect was designed to obtain conveniently spaced groups of trees and shrubs of varying lengths to avoid monotony and repetition.

34. Planting of the completed traffic islands along Wrightson Road was undertaken during 1937; two sections, one extending from Petra Street to Gatacre Street of *Cassia fistula* (Indian Laburnum) with variegated Hibiscus as an undershrub, and the other section from Gatacre Street to Charles Street with *Saraca tapingensis* and variegated Hibiscus.

35. *Cassia fistula* and the Hibiscus have developed well, whilst the *Saraca tapingensis* has been most difficult to establish under the existing exposed conditions.

36. It is regrettable that wanton destruction of the trees and shrubs has been brought about by a certain section of the public, as a result irregularity of the groups has occurred and replacements cannot now be effected until the next wet season. It was necessary, after irreparable damage had been done to seek Police assistance.

General.

Trees on Government lands, Port-of-Spain.

37. Periodical inspection and attention were given to trees on Government lands within the Port-of-Spain district, this Department now being responsible for their maintenance. Trees on the following lands received attention :—

St. James Military Cemetery.
Colonial Hospital.
Girls' Industrial School.
St. James Barracks.
Auditor's Quarters.
St. Clair Restricted Area.
Education Offices.
Queen's Royal College.
Four Roads Police Station.
Red House Grounds.

38. In January an experiment trial was undertaken with " Naga " powder to combat a serious attack of mole crickets at the St. James Barracks Sports Ground. Complete denudation of one field and between encroachment of the insects over a large area of the second field had occurred before any report was made to control the pest. Application of 5 lb. per 1,000 square feet was found to be effective for the destruction of the pest, and there was no visible injury to the grass surviving. When the application was increased to 7 lb. per 1,000 square feet a slight scorching of the grass resulted. Activity of the mole cricket continued with no apparent diminution for three weeks after the application, thereafter it became less marked and ceased entirely about six weeks after the treatment had been applied. Subsequent growth of the grass and its extension to the denuded portions was rapid and within four months an entire covering of Savannah grass was regenerated. There has been no subsequent mole cricket infestation in the area.

39. The Herbarium has been maintained in good condition during the year, and 109 new specimens were laid in, making a total of 13,361 in the Register.

40. Professor Cheesman of the Imperial College of Tropical Agriculture has continued to work on the Flora of Trinidad and Tobago, and at his request eight parcels of specimens were sent on loan to Kew, New York and elsewhere for examination and determination by botanists specialising in the various families of flowering plants concerned. A large proportion of the material in the Herbarium now carries authentic and up-to-date determinations.

41. Exchanges of orchid plants with collectors local and abroad continues favourably, and has resulted for 1938 in the acquisition of many interesting and noteworthy species.

42. The following established plants of hybrid Catteleyas were purchased locally :—

Cattleya Armstrongiae.
Do. Fabia.
Do. Fabia (extra good form).
Do. Fabia X. C. labiata.
Do. Hardyana.
Do. Maurice Verdonch.
Do. Radium.
Do. Robin Measules (C. Rajoi X. C. Daviana).
Laelia Cattleya Ronald.
Cattleya Stoneyware.
Do. Zoe.

43. The number of packets of seeds distributed in 1938 increased by 353, the total in 1937 being 402 as compared with 367 in 1936.

44. At the request of Messrs. Merck & Co., Rahway, U.S.A., collections of Immortelle seeds were made, and a total of 800 lb. was shipped, comprising 250 lb. of *Erythrina glauca* and 550 lb. of *Erythrina micropteryx* to be used in research work on the alkaloid content.

45. The Department gratefully acknowledges the many donations of seeds and plants from sources local and abroad.

Abroad—David Barry, Esq., Los Angeles, U.S.A.
H. Bryan, Esq., Honolulu.
W. R. Coe, Esq., New York, U.S.A.
Botanic Gardens, Dresden, Germany.
Experiment Station, Mayaguez, Puerto Rico.
Harrison W. Smith, Esq., Papeaie, Tahiti.
W. R. Holloway, Esq., Gordonvale, Australia.
W. Launder-Millin, Napier, New Zealand.
Mrs. Langlois, Nassau, Bahamas.
Lyons Botanic Gardens, France.
Col. H. R. Montgomery, Miami, Florida.
Missouri Botanic Gardens, Balboa, Canal Zone.
Royal Botanic Gardens, Kew, England.
United States Department of Agriculture, Washington, U.S.A.
Messrs. Vilmorin Andrieux et Cie., Paris, France.

Local—F. Anduze, Esq., Port-of-Spain.
Mrs. H. Fitt, Port-of-Spain.
Messrs. Kern Trinidad Oilfields, Ltd.
Mrs. McCarthy, Port-of-Spain.
Mrs. P. Urich, Port-of-Spain.
Col. Wilson, Diego Martin.

R. E. DEAN,
Curator, Royal Botanic Gardens.

GOVERNMENT STOCK FARM, TRINIDAD, 1938.

General.

Staff.

Dr. J. L. Shannon, D.V.M., Assistant Officer-in-Charge of the Farm was appointed to the newly created post of Livestock Officer in the Department early in the year.

2. The post of Assistant Officer-in-Charge, Government Farm, was abolished and the following appointments were made :—

(i) Mr. J. H. Brooks, 2nd Class Clerk, was promoted to the new post of 1st Class Clerk and Supervisor from 1st January, 1938.

(ii) Mr. P. J. Dominique, Field Assistant and Storekeeper, was appointed Overseer and Storekeeper from the same date.

(iii) Mr. O. R. Rampersad, 3rd Class Clerk, was transferred from Head Office to the newly created post of 3rd Class Clerk at the Stock Farm and assumed duties on 21st February, 1938.

3. Dr. M. D. Lumsden, B.V.Sc., Veterinary Officer, Trinidad, was stationed at quarters formerly occupied by the Assistant Officer-in-Charge on the Farm to assist in veterinary duties and breeding experiments.

Encouragement of Livestock Rearing.

4. The recommendations of the Animal Husbandry Committee reported in 1937 were put into effect early in the year, and the itinerant breeding units were placed under the supervision of the Livestock Officer.

5. The number of breeding units were increased from two to three and at times to four, and the period of stay in a district was extended to three months instead of two. In this way fourteen districts were served by stud animals from the Stock Farm.

6. Arrangements have been made to increase the number of breeding units to four in 1939 and to extend their stay in each district to four months. It is hoped eventually to have a certain number of breeding units standing permanently in certain districts of the colony where their services are most in demand.

Itinerant Breeding Units.

7. An itinerant breeding unit consisted for the most part of a Jack Donkey for mule and donkey breeding, a pure bred Holstein Friesian Bull, a British Alpine or Anglo Nubian Buck Goat, and whenever required, a boar pig and a thoroughbred stallion.

Animals Served.

District.	Horsekind (mares to stallions).	Mule Breeding (mares to Jacks).	Jenny Donkeys.	Cows.	Goats.	Sows.
Moruga	...	4	7	4	4	1
River Estate (Diego Martin) ...	...	...	...	18	3	4
Cedros	5	3	15	16	4	...
Woodford Lodge (Chaguanas) ...	11	...	...	4	2	2
Forres Park (Claxton Bay) ...	...	...	...	12	2	...
Mayaro	...	8	1	30	1	2
Princes Town	...	19	16	11	3	6
Arima	...	1	1	16	5	...
Penal	...	10	9	24	5	...
Ecclesville (Rio Claro)	...	...	...	15	2	...
Toco	...	5	2	2	2	3
Tacarigua	...	4	2	20	6	...
Sobo	...	...	...	16	16	...
Debe Settlement	...	...	...	...	3	...
	16	54	53	188	58	18

8. Besides the breeding units a number of stud animals were again stationed in districts under the care of private individuals or estates during the year for the benefit of the district :—

District.	*Name.*	*Animal.*	*Period.*
San Juan	...Mr. Small	...British Alpine buck goat (pure bred)	...January-December.
Port-of-Spain	...Sergeant-Major Cox	... do. do.	...September-December.
Madras Settlement	...Mr. C. C. Abidh	... do. do.	...August-December.
Todd's Road	...Mr. W. MacMillan	... do. do.	...September-December.
Arima	...Mr. E. Maingot	... do. do.	...August-December.
Chaguanas	...Mr. L. Woodbrook	...British Alpine buck goat (grade)	...March-December.
Belmont	...Mr. C. Vincent	... do. do.	...February-December.
Dabadie	...Mr. Darceuil	... do. do.	... do.
Port-of-Spain	...Mr. A. Serrao	... do. do.	...March-October.
Boissiere	...Mr. J. Harry	... do. do.	...March-June.
Manzanilla	...Mr. R. Kernahan	... do. do.	...July-December.
Williamsville	...Mr. A. Melizan	... do. do.	...July-December.
Do.	... do.	...Berkshire boar pig (pure bred)	... do.
Four Roads	...Mr. G. Sankar	...Large Black boar pig (pure bred)	...February-July.
Do.	...Mr. Cumberbatch	...Berkshire boar pig (pure bred)	...July-December.
Do.	...Mr. H. Sankar	...Holstein Bull (pure bred)	...February-December.
Cumuto	...Mr. O. P. Bennett	... do. do. ...	...January-December.
Enterprise	...Mr. Cumberbatch	... do. do. ...	...February-April.
Curepe ...	...Mr. Barban	... do. do. ...	...January-April.
Madras Settlement	...Mr. C. C. Abidh	... do. do. ...	...May-July.
Dabadie	...Mr. Darceuil	... do. do. ...	...September-December.
Do.	do.	...Zebu Foundation Bull ...	... do.

9. The report of the Livestock Officer printed elsewhere gives a full account of the breeding work carried out in outlying districts of the colony.

Transfer of Animals to Tobago Stock Farm.

10. The following animals from this institution were transferred to the Tobago Farm during the year in order to increase the breeding stock in the Island-Ward.

1 pure bred Sussex Bull.
2 grade Sussex Bulls.
1 Jack Donkey (imported).
1 Jack Donkey (locally bred).
1 pure bred British Alpine Buck (Clown 2).
1 grade British Alpine Buck (Chip 3).
1 Anglo Nubian Buck (Malpas Mulberry).
5 pure bred Berkshire Sows.
1 pure bred Berkshire Boar Pig.
39 pure bred Rhode Island Red Chickens.

Livestock Exhibition.

11. The Agricultural Society held its third annual Livestock Show at the Race Stand and Paddock on the Queen's Park Savannah from the 21st to 23rd October, and the Farm was again allotted the saddling enclosure and boxes for its exhibits which were not for competition.

12. The following were the livestock from the Government Stock Farm at the Stock Show :—

Horsekind.
2 Thoroughbred stallions (Young Native and Bachelor's Tut).
1 Imported Kentucky Jack Donkey.
1 Locally bred Kentucky Jenny Donkey.
1 Kentucky Jack Donkey (son of the above donkeys).
1 Half bred Jenny and three-quarter bred foal.
1 Three-quarter bred Jenny and seven-eighth bred daughter.

Cattle.
The pure bred Holstein Bull " Sir Inka May 45th " imported from the Carnation Farm, Seattle, Washington (1935).
Pure bred Sussex Bull and Cow.
Pure bred Zebu Bull and Cow.
A Murrah Water Buffalo Bull (Black), Cow and Bull Calf.

Goats.
British Alpine Goats (dairy breed).
Indian Goats (mutton breed).
Anglo-Nubian Goats.

Sheep.
Blackhead Persian Sheep.

Pigs.
A Boar and a Sow of Large Black and Berkshire Pigs.

Poultry.
A trio of Rhode Island Reds, Barred Plymouth Rocks and White Leghorns.

13. During the Exhibition a milk bar was run by the Farm staff for the Exhibition Committee.

Cattle.

14. The Murrah Water Buffaloes specially selected for the Farm by the Imperial Agriculturist, Pusa, India, were kept tethered in a coconut grove with the young dairy Zebu stock and handled daily. The two cows calved in September, one a bull and the other a heifer for the older bull (Black). These young calves are doing extraordinarily well and should make good specimens of the breed.

15. The two bulls were rented out to the following estates at $8.00 per month as follows :—

Estate.	*Period.*	*Rental.*
(1) *Brown Bull.*		
Mes Voeux Estate, Longdenville	...15th January-March (2½ months) ...	$20 00
St. Marie Estate, Cedros ...	...April-June (3 months)	24 00
Columbia Estate, Cedros ...	...July-September (3 months)	24 00
(2) *Black Bull.*		
Mes Voeux Estate, Longdenville	...1st-31st December	8 00
Woodford Lodge Estates, Chaguanas	...January-15th July (6½ months) ...	52 00
		128 00

16. The Animal Husbandry Committee of the Agricultural Society recommended during the year that the Society should make provision for the registration of these imported Murrah Water Buffaloes and it is intended to register all at the Farm in 1939.

Registration of Cattle.

17. The following animals born or purchased since our last registration in the Herd Book of the Agricultural Society in 1937 were registered during the year :—

Pure Bred Holstein Bulls	12
Pure Bred Holstein Heifer	1
Grade Holstein Bulls	7
Grade Holstein Heifers	25
Pure Bred Sussex Bulls	2
Grade Sussex Bulls	3
Grade Sussex Heifers	2
Pure Bred Zebu Bulls	2
Pure Bred Zebu Heifer	1
Zebu Foundation Bulls	9
Zebu Foundation Heifers	9
	73

Pure Bred and Grade Holsteins.

18. The pure bred imported Holstein Bull " Sir Inka May 45th " (June, 1935) has grown well and developed into a fine bull and during the year was bred to the following animals :—

	Heifers.	*Cows.*
Government Farm	8	34
Private	4	6
	12	40

During the year 10 calves by this bull were born and 5 were sold for rearing in outlying districts. A few of his sons have been selected for rearing on the Farm for the breeding units and two especially, one a pure bred and the other a ¾-bred out of the heavy milking half bred cow " Nymph " (12,000 lb. in 300 days), are growing into good specimens.

19. The pure bred British Friesian Bull " Lund Superblanche Julius 2 " died during the year from an acute attack of Piroplasmosis (Red Water Fever). His first crop of calves that were born early in the year are an extraordinarily good lot and his death is a great loss to this institution. The bull as a calf had been immunized against Piroplasmosis at Weybridge, Surrey (Laboratories, Ministry of Agriculture and Fisheries) before shipment to the colony, but in spite of this his resistance broke down.

20. The young pure bred " Carnation " Bull, " El Mena Carnation Wayne " (December, 1936) purchased from the Trinidad Dairies has grown well and his fertility was tested early in the year by breeding him to a few heifers and cows.

Importation of Holsteins from Canada.

21. In order to increase the number of breeding bulls for outlying districts, the following young pure bred Holstein bulls selected by Mr. C. A. Archibald (retired) of the Cattle Division, Department of Agriculture in Canada, were imported into the colony during the year :—

Name of Bull.	*Date of Birth.*
Browns Rag Apple Daybreak ...	...21st October, 1937.
Coos Gerben Pride	... 9th January, 1938.
Coos Segis Concordia	...17th March, 1938.
Posch Rag Apple Bessie Pride	...13th April, 1938.

Local Purchases and Exchanges.

22. The following bulls were purchased locally during the year :—

Breeder.	Name of Bull.	Date of Birth.	Dam.	Sire.
Sired in Canada	Champion ...	8th July, 1929 ...	Echo Lady Champion	Cobequid Hartog King Ormsby.
Macqueripe Plantations	Jack ...	15th March, 1933 ...	Miss Piet Colantha ...	Joe.
Robert Alefounder ...	Studley Duke...	27th April, 1937 ...	Studley Thelma 2 ...	Terling Glorious.
Trinidad Dairies, Ltd.	Woodford ...	13th January, 1933	Diamond	Colonel.

23. The pure bred Holstein bull " Llynvenith Rocharm " imported in 1937 from Canada was given in exchange to Waterloo Dairies in November for a locally bred pure bred bull " Waterloo ", winner in the yearling (1937) and two year (1938) classes of the Livestock Exhibition.

Holstein Bulls at the Farm.

24. " Sir Inka May 45th ", " Lund Superblanche Julius 2 " (until he died), " El Mena Carnation Wayne " and " Price Johanna Hartog " were used for breeding on the Farm throughout the year, and later in the year the fertility of Browns " Rag Apple Daybreak " was tested. All other pure bred bulls, including the five imported from Canada in 1937 as well as those locally purchased in 1937 and 1938, were sent out for service in outlying districts.

25. The selected grade Holstein-Zebu bulls, " Baldwin " (¾-bred Holstein) and " Champion " (½ bred Holstein) were again used on the Farm for ¾ bred and ½ bred breeding, but towards the end of the year " Champion " developed enteritis and could not be used. " Baldwin " was then used on the ½ bred cows as well to give a 5/8ths Holstein cross, inasmuch as a good ½ bred Holstein cross was not available and as in the past the results of ½ bred to ½ bred breeding were not encouraging. In breeding the " Santa Gertrudis " European cross in the United States of America, the 5/8ths European blood (shorthorn) have given the best results. The results of the ¾ bred breeding are satisfactory as heifers (daughters of " Baldwin ") calved during the year and milked well. Young ¾ bred bulls have been selected to take his place and two of these bulls were used for service at out-stations. A 15/16th selected grade Holstein also stood for service at Mucurapo Pasture during the year.

Sussex Cattle.

26. A pure bred Sussex bull originally selected by the Crown Agents for the British Virgin Islands (Tortola), was taken over by the Farm to be paid for in 1939 inasmuch as that island had decided to cancel the order, and it was the intention of the Department to import such a bull in 1939. The bull (yearling) arrived in the colony in June ; he had been immunized against Piroplasmosis at Weybridge, Surrey, before shipment and he was bred to a few cows and heifers during the end of the year. The Virgin Islands informed the Department that the bull was still required by them in November and arrangements are being made to let this institution keep the bull and to get the Crown Agents to select another one for the island of Tortola.

27. The pure bred Bull, " Flambeau " bred on the Farm died during the year and one pure bred bull and two grade bulls were sent over to Tobago for district work. The ¾ bred Sussex grade bulls from Zebu shorthorn cows are doing well and will do a great deal to improve the beef cattle in the island-Ward.

28. The following was the strength of the small herd of Sussex cattle at the Stock Farm at the end of the year :—

	Bulls.	*Cows.*	*Heifers.*	*Bull Calves.*	*Heifer Calves.*
Pure bred Sussex	...	2	1	3	...
Grade Sussex ...	1	7	3	4	6

Zebu Cattle.

29. The full-blooded and Zebu Foundation herds were made into one and placed in a large pasture: the full-blooded bulls (bred on the Farm) "Sultan" and "Bahago" were used alternately with the herd. The Zebu cows for grading with pure bred Holstein bulls and the Dairy Zebus were again kept separately.

30. The results from the Dairy Zebus, that are raised on the pail and handled from birth, have not been satisfactory, and inasmuch as such excellent results have been obtained in India with Sahiwal or Montgomery cattle for milking purposes, on the recommendation of the Animal Husbandry Committee of the Agricultural Society, Government provided a supplemental vote of $2,800.00 to import from India some of these cattle.

Sahiwal Cattle.

31. Two bulls and six young cows or heifers in calf were selected by Mr. Wynne Sayer, the Imperial Agriculturist in India, who reports that this dairy breed milks better than the European-Indian (dairy) crosses in that country, yielding over 10,000 lb. of milk per lactation breeding and at the same time standing up to tropical conditions excellently. The cattle are due to arrive in the colony early in 1939 and will be bred pure, but the bulls will be used as well for grading up on the Dairy Zebu cows and heifers.

32. It is intended to use the selected Dairy Zebu bulls (4) at the Farm in country districts as soon as possible in 1939, and to follow up in these districts later on with pure bred or grade Sahiwal bulls as they become available.

33. The following Zebu cattle were sold during the year:—

One Zebu Foundation Bull to Mr. J. E. Ramirez (Venezuela)	$90 00
One Zebu Foundation Bull to Mr. Salazar Sucre, (Venezuela)	120 00
One Zebu Foundation Bull to Mr. J. Bermudez (Venezuela)	105 00
One Zebu Foundation Bull to Mr. J. Gocool (Cedros)	50 00

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Two Zebu Foundation bulls to Mr. F. Castro (Costa Rica)	225 00
One Zebu Foundation heifer to Mr. A. Barnard (St. Lucia)	60 00
One Zebu Foundation heifer to the Hon. Geo. de Nobriga (Lowlands, Tobago) ...	66 00
One Zebu Foundation heifer to Mr. L. L. de Meillac (Mayaro)	56 00
One Zebu Foundation heifer to Mr. S. Calvert (Santa Cruz)	30 00
	$802 00

Pasturage and Service of Privately Owned Cows and Heifers.

34. One hundred and forty-four cows and heifers were bred to pure bred and grade bulls at the Government Stock Farm during the year (131 to pure bred Holstein bulls, 10 to pure bred Zebu bulls, and 3 to grade Holstein-Zebu bulls). The revenue derived from this source was $143.25.

35. At the Department's Bull Service Station at Mucurapo specially maintained (5 pure bred and 2 grade Holstein bulls) for the dairying districts around Port-of-Spain, the services were as follows:—

To pure bred bulls	235	cows and heifers.
To grade bulls	37	do.
	272	

At River Estate the number of cow and heifers served by the pure bred bull stationed there was 41.

36. At the Mucurapo Pasture where a bull was turned out every night an average of 76 head of cattle was pastured monthly during the year as follows:—

Cows	40
Heifers	20
Heifer calves	16
	76

A portion of this pasture was handed over to the Military and Police Departments. Owing to the continuous rains during the year there was no dry season and it was not found necessary to reduce the number of head pastured.

37. The number of cows and heifers admitted to River Estate for pasturage was as follows:—

Cows	38
Heifers	36
	74

38. At the Annual Sale on 3rd December, the following cattle were offered:—

Number.	*Average Price.*
17 Grade Holstein heifers	$ 58 00
4 Zebu Foundation heifers	53 00
2 Zebu Foundation bulls	112 50

Purchase of Dairy Stock.

39. Early in the year the Farm purchased from the Santa Cruz Dairy, that closed down, 12 grade Holstein cows in milk and 14 grade Holstein heifers. The heifers were nearly all in calf and were young animals, and the stock are all progeny of pure bred bulls purchased from the Farm or imported from Canada.

40. Owing to the decision of Government to start a small dairy herd at Cocorite Detention Station for the Leper Settlement at Chacachacare, 8 dairy heifers in calf and 5 cows were purchased and stabled at the Farm pending transfer to Cocorite on completion of dairy buildings and accommodation in 1939. The majority of the heifers purchased are the progeny of Farm bulls.

Milk Yield.

41. The dairy herd produced 45,377 gallons of milk during the year as compared with 33,898 gallons in 1937, and 33,368 gallons were supplied to the public institutions. The two grade cows (half-bred Holstein) "Nymph" and "Belle" again gave best results, the former yielding 11,458 lb. in 349 days and the latter 10,304 lb. in 307 days. Each cow's milk was weighed morning and afternoon and the weekly total transferred to a record book. The fat content of each cow and heifer was tested each month and the mixed milk averaged as follows :—

Morning milk	3·55
Afternoon milk	4·37

New Processing of Milk Plant.

42. Provision was made during the year to increase the processing of milk plant at the Farm (larger pasteuriser and compressor as well as installing a new engine and building a new cooling room in the dairy) in order to purchase milk—50 gallons daily—from the peasantry in the neighbourhood of the Farm and to process and bottle it on the Farm for distribution to school children within a radius of about eight miles of the Farm. Particulars were forwarded to the Crown Agents to call for tenders for the new plant.

43. In the estimates the expenditure and revenue of this new scheme have been allocated as follows :—

Revenue.		*Expenditure.*	
Sale of milk ...	$10,000 00	Processing Plant ...	$6,200 00
		Purchase of Milk ...	7,300 00
		Bottles, &c. ...	600 00
		Labour, &c. ...	1,842 00
	$10,000 00		$15,942 00

Demonstration at Health Week.

44. During the Health Week Exhibition of the City Council (12th-18th November) at the Prince's Building, Port-of-Spain, a demonstration was given twice daily (afternoon and evening) by the Stock Farm on the clean handling of milk in a dairy stall.

45. A model cow stall (stanchions) was also constructed on the grounds for the specific purpose of instructing the peasantry as to the proper housing (sanitary) of dairy cattle. Demonstrations in sanitary methods of milking and the testing of the butter fat content in milk were also carried out.

46. In order to popularise the use of goat's milk, a display of dairy goats (British Alpine) was afforded during the exhibition in an enclosure. The caring, feeding, handling, including milking of the goats, were carried out twice daily.

Health and Disease.

47. There were no cases of Paralytic Rabies (bat transmitted) on the Farm, and the cattle were, again vaccinated as a preventive measure early in the year.

48. In spite of preventive measures as outlined below, 14 cows and heifers aborted during the year : 120 of these animals calved normally. The infection seems to spread by the drainage of the dairy building flowing into the pasture especially during wet years, and arrangements have been made to change the course of the drains in a new system of drainage to be laid on the Farm in 1939. The preventive measures adopted were as follows :—

(1) Thorough disinfection.
(2) Segregating all aborting cows for two months.
(3) Placing all cows and heifers before calving in a "maternity" ward and leaving them in the calving boxes for 21 days after calving.

49. All the cattle on the Farm were again tuberculin-tested three times during the year, and there were seven reactors all of which were destroyed. Lesions of tuberculosis were also found in three other animals that had died or were destroyed for other causes. There were thirty-five deaths and the chief troubles were mortality in calves due to pneumonia and gastro-enteritis (parasitic) due to the excessively wet weather. The causes of deaths and destruction were as follows :—

Pneumonia	10
Gastro-Enteritis	8
Debility (hand reared Zebu calves)	5
Injuries (destroyed)	4
Metritis	3
Septicaemia	3
Piroplasmosis	1
Ophthalmia (destroyed)	1
	35

Horsekind.

50. The stallion "Young Native" gave better results during his second season and five mares seemed to be settled in foal for him at the end of the year. He stood for service at the Farm for the whole of the breeding season with the exception of short intervals at Longdenville (Mes Voeux Estate) for two weeks

51. The movements of the other three thoroughbred stallions during the 1938 season was as follows :—

Knight of St. Patrick (K.P.)	...Tobago ...	...January-December.
Nelsweep ...	...Trinidad (Farm) ...	do.
Bachelor's Tut	... do. (Chaguanas)	...February and during week-ends in May and June.
Do. ...	... do. (Cedros)	...March-April.
Do. ...	... do. (Farm)	...May-December.

These stallions services in Trinidad were as follows (Service fee $10.00 and groom's fee 60c.) :—

Stallion.	*Farm Mares.*	*Other Mares.*
Young Native	5	7
Nelsweep	2	2
Bachelor's Tut		21 { 3 at Cedros. 11 at Chaguanas. 7 at Farm.

52. The thoroughbred stallion "Nelsweep" (1915) is going down fast and steps will have to be taken early to replace him by another stallion.

Jack Donkey Stallions.

53. The Jack Donkey Stallions "Emperor 2", "Kentucky" (both imported) and "Jackie" (1934) bred on the Farm, stood for service with the breeding units during the year. The younger Jack Donkeys "Trinidad Joe" (1935) and "Penn" (1936), both pure bred Kentucky jacks bred on the Farm, have developed beautifully and were used solely for mule breeding on the Farm: they will both be bred to some jennies as well in 1939. The young three-quarter bred Kentucky Jack Donkey, "St. Clair" (1936), bred on the Farm, has also grown well and was used for donkey breeding (outside jennies) during the year.

54. Two young Jack Donkey Stallions (one a yearling) were imported from Mr. Tom Adams, Lexington, Kentucky, during the year for the Tobago Farm. The cost of these donkeys landed in the colony was $1,639.13. There were also imported during the year one half-bred Jack Donkey from British Guiana and two pure bred donkey foals (jack and jenny) from Barbados through Major T. Bone and Dr. C. Stoute, respectively.

55. The service fee for the Jack Donkeys for mule breeding was reduced to $2.00 instead of $4.00 on the recommendation of the Animal Husbandry Committee of the Agricultural Society from 15th April; the groom's fee remained the same.

56. The Jack Donkey services during the year can be summarized as follows:—

	Mares.	*Jennies.*
At the Farm	28	19
Breeding Units	54	53

The revenue received from the service of stallions (horse and donkeys) during the year was $397.00.

Breeding of Mares.

57. The thoroughbred mare "Barbara" foaled a filly by "Restigouche" and was re-bred to "Young Native" and "Bachelor's Tut;" she seemed in foal at the end of the year. The owner of "Restigouche" had an option on "Barbara's" foal at weaning age for $240.00 which he exercised. The thoroughbred mare, "First Offence" who had foaled prematurely at the end of 1937 was served by "Nelsweep" and was in foal at the end of year, and so was the thoroughbred mare "Saturnia" which was bred to "Young Native" in 1938 after failing to hold to the same stallion for his 1937 services. The thoroughbred mare, "Lotus", transferred from the Constabulary to the Farm for breeding purposes was bred to "Young Native" and "Nelsweep" and held late in the season.

58. The half-bred mare, "Cowbell" foaled a colt by "Restigouche" and the Honourable George de Nobriga also exercised the option at weaning age for $240.00. The half-bred mares, "Valerian" and "Wistaria" did not prove and were re-bred to "Nelsweep" and "Young Native" respectively. The old Police mare, "Rewa" foaled a colt by "Nelsweep" but none of the other old Police mares that were bred to Jack Donkeys proved to be in foal—they were all re-bred to the Jack Donkey Stallions.

59. The grey filly (1936) by "Nelsweep" out of the Police mare, "Vitalia" and the colt (1937) by the same stallion out of the Police mare "Blaney" have grown well and will be handed over to the Police Department early in 1939.

Donkey Breeding.

60. The half-bred Kentucky Jenny (St. Clair) had another filly foal by "Emperor 2"; both her 1937 and 1938 foals are growing well. The pure bred Jenny "de Gannes" and the three-quarter bred Kentucky Jenny, "Tacarigua" both foaled during the year a colt and a filly respectively, but they both died. All the Jenny Donkeys were bred again during the year including the young seven-eighth jenny by "Kentucky" out of "Tacarigua", either to "Emperor 2" or "Kentucky" (the two imported Jack Donkey Stallions) and they appeared to be settled in foal at the end of the year.

61. The young half-bred Jack Donkey Stallion, "Toco" by "Kentucky" out of the common jenny developed into a fine animal and was transferred to Tobago for donkey breeding during the year.

Pigs.

62. During the year three pure bred Berkshire gilts in pig and a young pure bred boar of the same breed were imported from Canada through the Dominion Department of Agriculture. Two of the gilts were heavy in pig, but the other which failed to hold came into oestrum and was bred shortly after her arrival on the Farm. Two boars from the litters of these sows were selected for rearing for outstation work. One of these gilts was sent to the Tobago Farm and farrowed there.

63. There was no necessity to introduce Large Black pigs during the year, but it is intended to import a boar and three gilts from England through the Crown Agents in 1939.

64. At the Annual Sale 38 young pigs (16 Large Blacks and 22 Berkshires) were offered and realized $539.50, an average of about $14.00 per head. Private sale of pigs during the year fetched $261.00, making a total of $800.50 as compared with $739.50 for 1937.

65. In addition to the Farm sows, 21 outside sows were served during the year at the Farm—service fees 75c. plus 25c. attendant's fee—and the revenue from the source was $15.75.

Goats.

66. During the year the following pure bred bucks were imported from England:—

Name.	*Breed.*	*Date of Birth.*
Didgemere Precision ...	...British Alpine	...26th March, 1937.
Malpas Midnight	... do.	...24th April, 1937.
Widdington Woden ...	... do.	...20th May, 1937.
Malpas Mulberry ...	...Anglo-Nubian	... 9th April, 1937.
Malpas Merrymac ...	... do.	...11th March, 1937.

The British Alpines were imported from Mrs. Arthur Abbey, Roydon, Essex, and the Anglo-Nubians from Mr. E. J. Egerton, Bramford, Ipswich. These purchases were possible owing to provision being made in the Estimates for an increase of $720.00 towards importing buck goats of dairy type.

67. The Animal Husbandry Committee of the Agricultural Society strongly supported the Department in a proposal to import Jumnapari goats—highly recommended by the Imperial Agriculturist in India as an excellent dual purpose type—and a supplemental vote of $750.00 to import four buck goats and six does or goatlings in kid from India was approved by the Finance Committee for this purpose. The goats have been selected and are due to arrive in the colony early in 1939.

68. It is intended to breed British Alpine and Jumnapari goats pure, and to cross the Anglo-Nubian buck goats with the lop-eared (local Indian type) does to produce a dual purpose animal.

69. The pure bred British Alpine continues to give satisfactory results and all those bred at the Farm are now pure bred. The number of these animals on our strength at the end of the year was as follows :—

Bucks	17
Buck Kids	3
Does	10
Goatlings	2
Doe kids	2

70. Fifty-eight does were bred to the bucks in the breeding units, 75 were served at Mucurapo Service Station and 112 at the Stock Farm. The revenue received at the Farm from this source was $84.00—service fee 75c.

71. The dairy type of goat (British Alpine) was again a good exhibit at the Health Week Exhibition of the City Council.

72. It was decided not to offer any buck goats at the Annual Sale and to retain them for the breeding units. Nine pure bred British Alpine does and goatlings were offered at the Annual Sale and realized $320.00, an average of about $35.00 each. Private sale of goats during the year fetched $22.00 making a total of $342.00.

73. During the year three imported pure bred British Alpine buck goats died ; two of them were imported in 1937, " Boddington Campion " (April) and " Didgemere Drelite " (November) and they had been used in country districts. The other buck goat, " Didgemere Precision " was imported during the year (August) but from the time of his arrival his health was unsatisfactory.

74. It was decided by the Agricultural Society during the year to register British Alpine, Anglo-Nubian and Jumnapari goats, and it is proposed to register all such goats on the Farm in 1939.

Blackhead Persian Sheep.

75. A pure bred ram was born during the year and a young ram of serviceable age was sold to Mr. J. Fernandes for $40.00 for grading up his flock at Forres Park Estate.

76. Ten ewes (grade blackhead and common sheep) were bred to the pure bred ram at the Farm—service fee 75c.—and the revenue from this source was $7.50.

Poultry.

77. The Plymouth Rocks (Barred) again gave excellent results and the birds offered at the Annual Sale were very good. Better results were obtained with the Rhode Island Reds than in 1937—both laying and fertility were improved. In the case of the White Leghorns there was a setback during the year and it was found necessary to import air-mail chicks from the United States of America to make up the stock for the Annual Sale.

78. All our chicks were hatched in incubators and reared on wire until they feathered with satisfactory results except in the case of the White Leghorns.

79. The pens were broken up in April again and were made up in October to prepare for the hatching season (1938-1939). A number of chicks were hatched in November and December and were doing extremely well at the end of the year.

80. At the Annual Sale 42 lots of poultry (78 birds) and six lots of Muscovy ducks (18 birds) were sold for $285.55. The highest prices paid were $14.25 and $13.50 for two and three trios respectively of Barred Plymouth Rocks.

81. The number of eggs laid during the year was 3,265 most of which were used for hatching purposes. The revenue derived from the sale of eggs was $129.74.

82. The hardy strain of white Muscovy ducks laid well during the year and a large number of ducklings was reared.

Pasturage and Stabling.

83. Mares were stabled during the breeding season for mating to the thoroughbred stallions, " Young Native " and " Bachelor's Tut ". A few mares and jennies were pastured for breeding to the Jack Donkey stallions. Throughout the year a number of cows were pastured for breeding to the Holstein and Zebu bulls. The goat stabling accommodation was again fully used up, but only a few sows and sheep were sent to the Farm for breeding. The revenue for pasturage and stabling was $1,667.28.

Sale of Stock.

84. A meeting of the Animal Husbandry Committee of the Agricultural Society was held at the Farm in October in order to afford the members an opportunity of inspecting the stock to be offered at the Annual Sale.

85. The Annual Sale was held on the 3rd December and the attendance was again good.

86. The sale was conducted by the Officers of the Farm and the amount realized was $2,591.05 as compared with $3,159.75 for 1937. Details of the various classes of stock sold at the Sale are as follows :—

Classes.	*Number.*	*Value.*
Cattle	23	$1,446 00
Goats (pure bred)	9	320 00
Pigs	38	539 50
Poultry	78	267 50
Ducks	18	18 05
		$2,591 05

87. Private sale of stock amounted to $1,485.44 as compared with $2,225.52 in 1937 making a total of $4,076.45 as compared with $5,385.27 in 1937.

Rainfall, Pasturage and Fodder Crops.

88. The rainfall for the year was high—79.25 inches as compared with 55.72 for last year. The lowest rainfall was 1.20 inches during February and the highest averages were 12.71 and 12.59 inches for November and August respectively.

89. With the exception of the low rainfall in February, the distribution was even throughout the year and no real dry season or Indian summer was experienced. The pastures were green throughout the year and the yields from the grass fields were good.

90. The pen manure was applied to the grass fields and spread out when not required for storing for cane cultivations. Fodder was supplied to the Constabulary during the year and the Farm also supplied all the green fodder for the Agricultural Exhibition. The revenue from the sale of grass, chiefly from the Constabulary, amounted to $2,391.25 as compared with $2,142.58 for 1937.

Uba Canes.

91. Very little Uba canes were cut last year (1937) and the fields should normally meet requirements for 1939, but owing to the heavy rains the fields have not ratooned as well as usual. It will be necessary to plant about four acres of this emergency fodder during next year in order to put the bulky food requirements on a more secure position.

Sugar Cane.

92. Crop was started on 7th March and ended on 18th April. The canes were supplied to the Orange Grove Factory and the tonnage delivered was 785 tons 5 cwt. 1 qr. The revenue realized was $2,073.08 and the price paid was $2.64 per ton. In 1937 the canes were sold for $2.76 and the tonnage (1,008 tons 15 cwt. 2 qrs.) was higher, the revenue being $2,874.18. Eleven acres were planted during the year and it will be possible to cut 9 acres of this cane in 1939. The estimate for the 1939 crop is 800 tons.

Coconuts and Limes.

93. The price of coconuts was very low during the year and most of the nuts were used for feeding to the pigs. Some local sales were effected and the price realized was about $7.00 per 1,000 nuts. The revenue from this source was $297.59.

94. The lime hedges were cleaned and trimmed during the year and the yield was satisfactory. Ripe limes were sold and the revenue derived from this source was $150.30.

Water Supply.

95. Owing to the heavy rainfall the subsidiary water supply from the Blake's Ram in the St. Joseph River was considerably interfered with. Further, the Ram did not pump as effectively later in the year and the Public Works Department was asked to import a supply of rubber valves.

96. The road between the St. Augustine Nurseries and the Farm was considerably damaged by the St. Joseph River. The Public Works Department had intended to extend the apron across the river on both banks, but this was not done as it will be necessary to alter the course of the road and bridge the river at another spot.

Improvements and Repairs.

97. The Public Works Department carried out the following work at the Farm :—

(1) Erection of a new calf pen.
(2) Renovation of the bull pen in the pasture west of the St. Augustine Nurseries.
(3) Addition of two rooms to and painting of the Dairy Foremen's Quarters.
(4) Painting and distempering of the main cowshed.

98. Work was also started by the Public Works Department to lay out a new system of drains on the Farm prior to the erection of twelve cottages for workers at this institution early in 1939.

Educational Work, Visitors, &c.

99. The Animal Husbandry Committee of the Agricultural Society held one of its meetings at the Farm. The Principal, some members of the Staff, the post-graduate and senior diploma students of the Imperial College of Tropical Agriculture held one of their field outings at the Farm in November. Arrangements were also made for the second year diploma students to visit the Farm for their practical classes in Veterinary Science during the year. The following Societies, Bodies and Schools paid visits to the Farm during 1938 :—

Cedros District Agricultural Society.
Ecclesville District Agricultural Society.
Young Men's Association of Fyzabad.
Ecclesville C.M. School.
Caroni C.M. School.
Bien Venue C.M. School.
San Francique C.M. School.
Vista Bella C.M. School.
Guaico C.M. School.
Debe C.M. School.
Maraval R.C. Boys' School.
Princes Town R.C. School.
Belmont R.C. Boys' School.
Cumuto R.C. School.
Richmond Street E.C. School.
Escallier Land E.C. School.
St. Clement E.C. School.
Princes Town E.C. School.
Coffee Street E.C. School.
Longdenville Government School.
St. Joseph Government School.
Archibald Institute, St. Augustine.

100. The following were among the visitors to the Farm during the year :—

His Excellency the Acting Governor, Sir Mark Young.
The Honourable Colonial Secretary.
The Deputy Colonial Secretary.
The Honourable Treasurer.
The Honourable E. V. Wharton.
The Honourable George de Nobriga.
Mr. W. Glossop (England).
Mr. W. W. Poll (England).
Lady Judith Meyrick (Bermuda).
Mr. C. T. Laurence (Bermuda).
Mrs. Elizabeth Gordon (Baltimore, U.S.A.)
Mr. G. A. Jones, C.M.G.
Mr. E. Musgrave (Dominica).
Reverend Father P. L. O'Sullivan, O.P.
Mr. A. W. Christie, B.S., M.S. (California).
Dr. L. N. Deckers (Netherlands).
Mr. E. P. Ward (St. Lucia).
Mr. C. de Freitas-Martins (Madeira).
Dr. F. Sardeman, Veterinary Surgeon (Curacao).
Mr. Stewart Massiah (Barbados).
Dr. E. F. Gordon (Bermuda).
Mr. C. L. Trestrail.
Dr. E. E. Maclachlan.
Dr. Cyril Gittens.
Major T. Hodgins.
Mr. S. Liddelow.
Mr. C. W. Fleming.

Revenue and Expenditure.

Revenue.	$ c.	Expenditure.	$ c.
Sale of Stock	4,076 49	Personal Emoluments	6,237 46
Sale of Canes	2,073 08	Maintenance	13,555 93
Sale of Milk	21,061 55	Travelling	323 44
Sale of Eggs	129 74	Motor Lorry Expenses	1,147 46
Stud Fees	1,037 50	Expenses of Annual Sale	99 65
Stabling	1,042 23	Materials	1,832 44
Pasturage	625 05	*Stock—Purchase	9,822 78
Sale of Grass	2,391 25	Do. Feed, Purchase of	8,219 48
Miscellaneous	673 04	Do. Expenses of stallions	719 70
		Entertainment of Visitors	23 08
	$33,109 93		$41,981 42

* Includes the following :—

(1) Purchase of 2 Jack Donkey Stallions for the Tobago Farm	$1,639 13
(2) Deposits on order for the Sahiwal cattle and Jumnapari goats from India ...	3,572 00
	$5,211 13

H. V. M. METIVIER,
Officer-in-Charge,
Government Stock Farm, Trinidad.

REPORT OF THE VETERINARY DIVISION, 1938.

General.

Mr. M. D. Lumsden, B.V.SC. (Ontario), Veterinary Officer, Trinidad, who was on leave at the end of 1937 returned to the Colony on the 30th January and resumed duties immediately.

2. Dr. J. L. Shannon, D.V.M. (Iowa), Veterinary Officer attached to the Farm was appointed to the newly created post of Livestock Officer with his office at the Farm. He vacated his quarters at the Farm and was given a house allowance in lieu thereof.

3. A re-arrangement of veterinary duties took place on this appointment and Mr. M. D. Lumsden moved into quarters on the Farm to assist the Senior Veterinary Officer in all veterinary duties at the Farm, and in general throughout the Colony.

4. At the request of the Government of the Windward Islands, I again visited the island of St. Lucia in November in connection with the livestock improvement work in that colony.

5. On my way to and from St. Lucia I again spent 3 days in the island of Barbados, and through the kindness of the Veterinary Officer there I had an opportunity of seeing the livestock work in that colony. An opportunity was also given me of discussing the outbreak of Swine Fever in Barbados.

6. Arrangements were made for me to land at St. Vincent on my return to Trinidad, at the request of the Administrator of that colony, in order to discuss the extension of the pig breeding industry and other small stock rearing in that colony.

7. Mr. T. A. des Iles, B.V.SC. (Ontario), Veterinary Officer, Tobago, was granted casual leave in Trinidad during the year, and also duty leave to attend the Livestock Exhibition in Port-of-Spain in October for the purpose of judging in some of the classes.

8. The Nutrition Committee of which the Senior Veterinary Officer is a member held very few meetings during the year, but its recommendations for livestock improvement were further carried out by the purchase of 6 dairy bulls (2 locally and 4 from Canada) as well as 5 buck goats (all imported from England) during the year. In this way the Itinerant Breeding Units of the Government Stock Farm were able to carry out the 1938 programme satisfactorily.

9. The Animal Husbandry Committee of the Agricultural Society strongly supported the recommendation of the Department of Agriculture to Government to import Sahiwal or Montgomery cattle, an indigenous tropical dairy breed, and Jumnapari goats (dual-purpose animals) from India late in the year. Although this expenditure has been debited to the Stock Farm, it is intended to reduce the livestock purchase vote in 1939 to compensate for the extra expenditure in 1938.

10. In the island-ward of Tobago in conjunction with the Inspector of Schools the Veterinary Officer has inaugurated a Juvenile Farm Club for school children and a successful exhibition was held at the close of the year. The Livestock Officer proceeded to Tobago to assist in judging and at the same time he was afforded an opportunity to speak to the school children, parents, and teachers on the need for livestock development and improvement.

11. An Agricultural Exhibition in which livestock played an important part, was held in Tobago in September last. The livestock exhibits were of a high standard and both the Livestock Officer and the Senior Veterinary Officer assisted in judging. Arrangements are being made for holding another exhibition in Tobago in 1939.

12. In order to encourage the rearing of livestock more generally in the colony, the Standing Exhibition Committee, with funds provided by Government, decided to hold several after crop (cane) shows for cane farmers and peasants in the following districts of the colony :—

On 24th September, 1938, at 1.30 p.m.

Centres.	*Locality.*
Tacarigua	...Orange Grove Recreation Grounds.
Caroni	...Curepe Savannah.
Carapichaima	...Carapichaima Recreation Grounds.
Couva	...Spring Polo Grounds.

On 1st October, 1938, at 1.30 p.m.

Chaguanas	...Woodford Lodge Estate.
California	...Esperanza Estate.
Williamsville (Ben Lomond) ...	Savannah near Rajack's Shop.
Debe Settlement (Picton, Debe and Union Hall)	...Dumfries Cane Farmers Scale Site.
Princes Town	...Malgretoute Savannah.

13. These District Livestock Shows proved a success ; it is hoped to make them annual events, and in conjunction with the large Sugar Companies to run them on a larger scale. The Committee is making arrangements to also encourage the District Agricultural Societies to stage exhibitions more often.

14. The Agricultural Society held its third Annual Livestock Exhibition in October at the Race Stand and Paddock on the Queen's Park Savannah, Port-of-Spain. In spite of unfavourable weather the Exhibition was well attended and Government has again provided a grant for the holding of a similar Livestock Show in 1939. Many of the prize-winners of the Tobago and District Shows competed successfully at the larger Trinidad Show.

15. With money available for livestock improvement work (shows, exhibitions, &c.), it was decided by the Exhibition Committee to purchase 4 heifer calves and 24 rabbits for distribution to 4 and 8 schools respectively, specially selected by the Director of Education with a view to fostering a practical knowledge of animal husbandry among school children. Provision has been made in the estimates for 1939 to extend the scheme, and to distribute to some schools as well, baby chicks for rearing.

16. This Division provided the Medical Department with an estimate for establishing a small dairy at the Cocorite Detention Station in order to supply fresh milk to the Leper Settlement at Chacachacare.

17. It is pleasing to record that the incidence of Paralytic Rabies (bat-transmitted) which caused such high mortality in livestock and greatly interfered with the rearing of animals throughout the colony in past years, has dropped considerably and there were only 2 cases during the year. Both cases were in cattle and occurred in the Mayaro and Longdenville districts.

18. The Medical Department continued the work in regard to the destruction of bats throughout the colony during the year, and a " Rabies " Inspector was again attached to this Division to assist the Veterinary Officers in the field work (inoculations, &c.), with this disease.

19. The Government Bacteriologist (Medical Department) carried out further researches in this disease during the year. There were no human cases reported.

20. The Senior Veterinary Officer attended all the meetings of the Board of Agriculture, and presented reports on Paralytic Rabies which were published in the daily papers.

A.—DISEASE CONTROL.

(1) Field Operations.

Proclaimed Diseases.

21. *Equine Encephalomyelitis.*—Recommendations were made at the end of the year for this disease to be proclaimed a disease under the Diseases of Animals Ordinance, Cap. 256 owing to the prevalence of this condition on the mainland of Venezuela. It was further recommended that the importation of horse kind from that country should be prohibited.

22. *Anthrax.*—Two (2) cases of Anthrax were reported during the year, one in a heifer on the Mucurapo Pasture, Port-of-Spain and the other in a bovine on La Carmencita Estate, Ecclesville (Rio Claro). The necessary preventive measures were enforced and the in-contact animals were vaccinated against the disease.

23. *Glanders and Epizootic Lymphangitis.*—Mallein was issued to two (2) Veterinary Officers (private) for testing animals, but no cases were reported.

24. *Swine Fever.*—Owing to the continued occurrence of cases of Swine Fever in the island of Barbados the restrictions against the importation of swine, carcasses, &c., from that colony were enforced throughout the year.

25. *Foot and Mouth Disease.*—The Department gave permission for the following animals to be imported from the United Kingdom :—

1 Sussex Bull.
1 British Friesian Bull.
5 Dairy Buck Goats.

The two (2) bulls passed through the Field Laboratories of the Ministry of Agriculture and Fisheries at Weybridge where they were immunized against Piroplasmosis and Anaplasmosis.

26. *Tuberculosis.*—In the rural districts around Port-of-Spain 1,217 head of cattle were tested in 442 cowsheds and there were 4 reactors which were all destroyed and their owners compensated. Seven (7) reactors were also destroyed at the Stock Farm. On one of the Sugar Estates where an ox was sold to the butcher showing lesions on post-mortem examination all the in-contacts were tested and the reactors destroyed. Fifteen (15) cases were discovered at the Port-of-Spain Abattoir, 12 were in imported cattle from British Guiana and 3 in local animals (Sugar Estates). At the San Fernando Abattoir 8 cases were found (local animals).

27. *Rabies.*—Thirty-seven (37) dogs including 9 intransit and one (1) cat were quarantined against Rabies on arrival in the colony. No cases of Rabies occurred in these animals, but 9 dogs died from other causes as follows :

Distemper	1
Pneumonia	2
Tetanus	1
Gastro-enteritis	6

Four (4) of the cases of Gastro-enteritis were due to arsenical poisoning (accidental) owing to the presence of sodium arsenite in the walls of the kennels which had been sprayed to control ticks.

28. *Paralytic Rabies in Livestock (Bat-transmitted).*—Only 2 cases were reported, one in January and the other in December, and the position in regard to this disease is now quite satisfactory. The disease was again controlled by the following precautionary measures (*a*) vaccination of livestock, (*b*) destruction of bats by shooting, trapping, poisoning, &c. No cases of the disease occurred in protected animals. One thousand nine hundred and forty-nine (1,949) bats were examined by the Government Bacteriologist and of these 101 Desmodus bats showed Negri bodies. The distribution of these infected bats was again widespread throughout the colony.

Non-Proclaimed Diseases.

29. *Haemmhoragic Septicaemia.*—A few cases of this disease again occurred in Tobago and the disease was controlled by means of simultaneous treatment (serum and bavterin).

30. *Strangles and Influenza.*—More cases occurred during the year especially on the Sugar Estates as the American mules imported during the year were not protected against these conditions before shipment; they were shipped from New York and not New Orleans as in previous years.

31. *Tetanus.*—The use of Tetanus Antitoxin on the large Sugar Estates as a precautionary measure against Tetanus is meeting with good results.

32. *Parasitic Gastritis in Calves.*—Owing to the very wet weather parasitic infection was more marked in calves during the year. Owners of livestock were advised by the Department to use the copper sulphate treatment especially during the wet weather.

33. *Bovine Piroplasmosis.*—A British Friesian bull died at the Farm from an acute attack of "red water fever" (Piroplasmosis) although he had been premunized against the disease in England before shipment and had been in the Colony for over a year. Four (4) young bulls imported from Canada for the Farm just under a year old were all allowed to become naturally premunized with satisfactory results. No Anaplasmosis reaction was again seen in the young bulls.

34. *Ulcerated Lymphangitis in Horsekind.*—More cases were seen during the year owing to the very wet weather and the disease was again confused with Glanders (Farcy).

35. *Contagious Abortion in Cattle.*—Cases of this disease were again reported from the larger dairies, but the disease is practically unknown in smaller dairies, and among the cattle herds on the large estates. The recommendations by this Division is to restrict the introduction of new stock into herds and to get owners to rear their own young stock to replace adults and at the same time to carry out the following precautionary measures :—

(1) Stabling of all cows in calf in a "maternity" pen wherever possible.
(2) All calving cows to be segregated in this pen for 21 days after calving, before returning them to the herd.
(3) All aborting cows to be isolated for 2 months before they are put back to the herd.

36. *Contagious Ophthalmia in Calves.*—In most of the large dairies where this disease was common in pure bred and highly graded European stock (calves), the condition has been kept under control by paying more attention to the sanitary surroundings of the animals. The condition seems to be spread by flies.

37. *Pneumonia in Calves.*—A preventive vaccine, "Alvor" has been used for the treatment of this condition at the Stock Farm, but many cases of intestinal complications occur as well (White Diarrhoea) and it is intended to use a polyvalent vaccine next year.

Inspection of Animals.

38. The following animals were imported into the colony during the year and inspected :—

Horses—including 19 thoroughbreds from the United Kingdom, 6 riding horses from Canada for the Usine Ste. Madeleine Sugar Co., 16 from the British West Indian Islands and 71 Venezuelan ponies	112
Mules—including 125 large American mules (Kentucky), 32 small mules from the British West Indian Islands and 38 of the same type from Venezuela	195
Donkeys—including 2 imported Kentucky Jack Donkey Stallions (U.S.A.) and 143 from the Windward Islands	154
Dogs—including 29 from Great Britain and Northern Ireland and 15 from the United States of America (Hounds)	51
Cats—including 5 from the United Kingdom	6
Cattle—including a pure bred Sussex bull, a British Friesian bull and a Holstein heifer from the Carnation Farms (U.S.A.), 4 Holstein Friesian bulls from Canada, 7,323 head and 1,095 head of cattle from Venezuela and British Guiana respectively for slaughtering purposes	8,579
Pigs—including 2 Large Whites from England, 4 Berkshires from Canada, 772 from British Guiana and 5,068 from the Windward Islands chiefly for butchering purposes ...	5,852
Sheep—chiefly from the Windward Islands for mutton purpose	2,042
Goats—including 5 bucks (2 Anglo-Nubian and 3 British Alpines) from the United Kingdom and 6,085 from the Windward Islands for slaughtering purposes ...	6,099

Quarantine Station.

39. The following animals were admitted to the Quarantine Station :—

Horses	58
Mules	10
Donkeys	12
Cattle	8,419
Pigs	744
Sheep	...
Goats	...
Dogs	37 (9 intransit)

The new arrangements made for the landing of cattle and transporting them in special trucks by rail to the Quarantine Station have worked very satisfactorily, and the accidents during the year can be summarised as follows :—

Deaths.

Trampled	7
Debility	3
Septicaemia	2
Injuries	1

Emergency Slaughter.

Trampled	2
Exhaustion and Collapse	3
Injuries	6
	11

During the year the following cattle were vaccinated against Anthrax and Tuberculin tested at the Quarantine Station :—

Vaccinated against Anthrax	466
Tuberculin tested	20 (no reactors).

The fees for the duties by this Division during the year were as follows :—

Fees for examination of animals	$8,131 66
Contribution from City Council for supervision of Quarantine Station ...	480 00
Animal inoculations, &c.	557 76
Sale of Rabies vaccine	60 50
	$9,229 92

(2) Research Operations.

40. Work was chiefly concerned with Paralytic Rabies (bat-transmitted) in livestock and it was carried out by the Government Bacteriologist. The behaviour of the virus as well as the course of the disease in bats were reported last year and this year the research operations were devoted chiefly to experiments dealing with the transmission of the disease to dogs by artificially infected Desmodus bats. The incidence of this disease in dogs in the field is negligible, and the research work which was being carried out at the end of the year was to determine if it is possible to artificially infect them.

B.—ANIMAL HUSBANDRY.

(1) Field Operations.

41. In the reports of the Stock Farms detailed information is given on the activities of these institutions for the improvement of the livestock industry in the colony.

42. This work can be summarised under the following heads :—

(*a*) The standing of stud animals for service as follows :—

Thoroughbred Stallions.
Jack Donkeys for mule and donkey breeding.
Zebu Bulls (Work and Milk).
Holstein Friesian Bulls (grade and pure bred).
Sussex Bulls (beef).
Murrah Water Buffalo Bulls.
British Alpine Buck Goats (Milk).
Anglo-Nubian Buck Goats (Milk).
Indian Buck Goats.
Large Black Boars.
Berkshire Boars.

(*b*) The sale of pure bred and grade stock at an Annual Sale or privately as they become available during the year.

(*c*) Eggs from the following breeds of pure bred poultry as well as chicks during the hatching season were sold :—

White Leghorns.
Barred Plymouth Rocks.
Rhode Island Reds.

43. In order to further extend the activities of the Stock Farms and to encourage the rearing of livestock by the peasantry, a Livestock Officer was appointed and itinerant breeding units (3 and at times 4) were stationed in out-districts for periods of 3 months during the year. In this way 14 districts were served with units consisting for the most part of Jack Donkey Stallions (for mule and donkey breeding), pure bred bulls, buck goats, and boar pigs.

44. In addition to these units, arrangements were also made by the Livestock Officer to stand sires of the different classes of livestock for service wherever there was a demand. Further particulars of the work in this connection will be found in the report of the Stock Farms.

45. More sires were sent from Trinidad to Tobago for similar work during the year and two Donkey Stallions were specially imported from Kentucky (U.S.A.) for Tobago for this purpose.

46. In order to stimulate the breeding of mules by the peasantry the service fee of the Jack Donkey Stallion to mares was reduced on the recommendation of the Animal Husbandry Committee of the Agricultural Society from $4.00 to $2.00. In consequence of this reduction the number of services has increased.

47. The extension work in Tobago is under the Veterinary Officer stationed there who paid regular visits to out-districts especially schools in connection with the Farm Club Scheme.

48. The Stock Farms have been also used for demonstration purposes during the year to school teachers and children, colleges and agricultural societies, and in Tobago the Agricultural Exhibition as well as the Farm Club Stock Shows were held at the Stock Farm.

49. In Trinidad the Livestock Officer gave lectures to the following District Agricultural Societies during the year :—

Cedros District Agricultural Society.
Chaguanas District Agricultural Society.
Rio Claro District Agricultural Society.

(2) Research Operations.

50. *Dairy Cattle.*—Work is chiefly concerned in the breeding of suitable dairy cattle for the tropics, and provision has been made to introduce a typical indigenous tropical dairy breed—Sahiwal or Montgomery cattle—early in 1939 on the Stock Farms to compare their results with (*a*) the cross obtained between the Holstein Friesian (production) and the ordinary Zebu cattle (constitution), and (*b*) the specially selected and hand reared Zebu cattle from stock originally imported from the Hissar Farm, India.

51. *Beef Cattle.*—Sussex bulls have been crossed with Zebu foundation stock with good results, and the bulls as they become available are sent to Tobago where beef cattle can be reared at a profit.

52. *Goat and Sheep Breeding.*—The work of crossing British Alpine goats with common and grade Saanen stock has been continued, and selected bucks from high yielding pure bred British Alpine does were sent out to country districts as soon as they were available at the Farm.

53. At the end of the year an order was placed with the Imperial Agriculturist, New Delhi, India for the selection and shipment of the Indian dual-purpose goat—Jumnapari. These goats will be bred pure on the Farm and the bucks used for grading purposes as well.

54. The Anglo-Nubian Bucks have been crossed with the local Indian Lop-eared does and several kids were born during the year. It is hoped to obtain a dual-purpose goat with this breeding, and to compare them with pure bred Jumnapari.

55. The Blackhead Persian sheep when crossed with the African Woolless continued to give a hardy type of sheep and it has been noticed that the fecundity of the cross is better than in the case of pure bred Blackhead Persian sheep. Further the quality of the mutton is much better than the African Woolless.

C.—IMPROVEMENT OF MARKETING OF ANIMALS AND ANIMAL PRODUCTS.

(1) Animals.

56. The Veterinary Officer in Tobago with the co-operation of the Livestock Officer in Trinidad started a scheme for the marketing of stock shipped from Tobago to Port-of-Spain. Government has granted the Livestock Officer an auctioneer's licence and the animals are sold on arrival on the quay. It is hoped in this Colony to eliminate the middleman and to obtain better prices for peasant stock especially. In Trinidad the Stock Farm assist breeders by disposing of their stock especially for export, whenever possible, from orders received, and it is anticipated that breeders in Trinidad will be facilitated by the Livestock Officer as soon as animals are available for the local market.

(2) Milk.

57. It is intended to extend the tuberculin testing of all dairy cows in the Princes Town area in 1939 and to include San Fernando area probably in 1940. Pasteurised milk was supplied to certain school children in the compulsory area of Port-of-Spain and provision has been made in the Estimates to continue this scheme in 1939 as well as to extend it to the new compulsory area of San Fernando, and also to supply the rural schools within a radius of 8 miles of the Government Stock Farm. In the latter scheme the milk will be purchased from the peasantry, processed and bottled at the Stock Farm and then distributed.

(3) Animal Products.

58. The new method of preparing salted hides by drying them in a stove has been very successful, and they are now exported chiefly in this condition.

D.—VETERINARY EDUCATION.

59. Elementary lectures in veterinary science were given to the West Indian and other students pursuing their second year diploma course at the Imperial College of Tropical Agriculture. The post-graduate students were also given lectures on important tropical diseases in livestock more especially with regard to methods of control.

E.—STATISTICS.

Triennial Livestock Census taken in 1938.

Classes.	*Number.*
Horses	2,248
Cattle	22,195
Mules	4,415
Asses	5,532
Sheep	3,181
Goats	13,825
Pigs	17,058
Total	68,454

Importation of Livestock for food, 1938.

		Number.	*Value.*
Cattle	British Guiana	1,095	$22,637
	British West Indies	21	397
	Dutch Guiana	10	300
	San Domingo	107	2,996
	Venezuela	7,323	181,940
		8,556	$208,270
Goats	British West Indies	6,085	$10,719
Sheep	British West Indies	2,038	$4,808
	French West Indies	2	20
	Venezuela	2	8
		2,042	$4,836
Swine	British Guiana	772	$6,279
	British West Indies	5,068	37,590
	Venezuela	6	18
		5,846	$43,887
Poultry	British Guiana	11,509	$5,774
	British West Indies	37,326	15,212
	Dutch Guiana	856	454
		49,691	$21,440

Importation of Meat and Eggs, 1938.

	Weight. (cwt.)	Value. $
Fresh and Chilled Meat.		
Beef and Veal	9,920	104,302
Mutton and lamb	2,487	26,105
Pork	802	12,912
Other sorts	134	3,174
Poultry, dead	860	21,606
Game, dead	12	364
	14,215	$168,463
Pickled or Salted.		
Beef and Veal	12,446	104,680
Pork	16,330	149,521
Other sorts	32	561
	28,808	$254,762
Smoked or cured.		
Beef and Veal	6,928	60,269
Bacon and Ham	7,115	134,007
Other sorts	1,587	34,758
	15,630	$229,034
Canned, Tinned, &c.		
Pastes, &c.	435	6,963
Other sorts	4,743	91,804
	5,178	$98,767
Extracts and essences	25	$4,467
Eggs (in shell).	*Great hundred* (120).	
Canada	2,879	$10,190
British Guiana	145	648
British West Indies	25	46
United States of America	1	19
	3,050	$10,903
Eggs (not in shell).		
Canada	161	$4,509
China	113	2,174
United States of America	85	1,749
	359	$8,432

Importation of livestock from Tobago, 1938.

	Number.	Value.
Horses	24	$ 1,200
Mules	50	3,000
Donkeys	25	600
Sheep	618	2,472
Goats	2,180	6,540
Pigs	3,033	24,264
Cattle	813	24,390
Dogs	84	336
	6,827	$62,802
Poultry.	*Dozen.*	
Fowls	2,470	$14,227 20
Turkeys	6	172 80
	2,476	$14,400 00
Eggs	1,425	$ 427 50

H. V. M. METIVIER,
Senior Veterinary Officer.

REPORT OF LIVESTOCK OFFICER FOR 1938.

The extension of the work undertaken by the Government Farm for the development of the livestock industry in the colony, which included the placing of breeding units in certain districts, was further advanced during the year by the appointment of a livestock officer and an increase in the number of itinerant breeding units.

2. These breeding units were composed of a jack donkey for mule and donkey breeding, a pure-bred Holstein bull, a buck goat—either a British Alpine or Anglo Nubian, and a pure-bred boar, of either the Large Black or Berkshire breed. The service fee of the jack to a mare is $2.00, and to a jenny $1.00, plus 60c. stud groom's fees. The fee for the bull is $1.00, and for the boar and goat 75c. each.

3. The period of stay of these breeding units in a district was extended to three months instead of two.

4. Fourteen districts were served in this way as follows :—Moruga, Diego Martin, Cedros, Chaguanas, Claxton Bay, Mayaro, Princes Town, Arima, Penal, Rio Claro, Toco, Tacarigua, Sobo, and Debe Settlement. The best results were obtained from the pure-bred dairy bulls, as 164 cows and heifers were served in these rural districts. The number of other animals were : Mares 45, Jennies 48, Goats 54, Sows 20.

5. In order to carry out this extension work in the colony, 6 pure-bred Holstein bulls (4 from Canada and 2 locally) were purchased by the Government Farm during the year. Three British Alpine bucks of the Didgemere strain and two Anglo-Nubian buck goats were also imported.

6. The two Murrah Water Buffalo bulls imported by the Government Farm in 1937 (together with two cows and two bull calves) were stationed for service alternately at Cedros, Longdenville and Chaguanas, and Government Farm, at which institution the two cows have again calved, a bull and a heifer calf respectively. Incidentally it might here be pointed out that the Murrah Buffaloes imported from India for various sugar cane estates, have been a great success as the six bull calves which arrived with the cows are now in service with the original eight imported bulls, and the cows have all since calved again.

7. With the view of still further encouraging the development of local animal husbandry the Government Farm has ordered from India through the Imperial Agriculturist Mr. Wynne Sayer, 2 bulls, and 6 heifers or cows, in calf, of the Sahiwal or Montgomery breed ; and 6 Jumnapari doe goats in kid, and 4 bucks. The Jumnapari goats are famous as large dual purpose goats, from which the Anglo Nubians have descended, and both these goats and the Sahiwal cattle which are excellent milkers should prove suitable for establishing pure breeds likely to prove a success in this climate, as well as for crossing and grading up on local material of both Indian and Holstein blood. Breeding unit work in the outlying districts of Tobago has also been carried out by supplying the Tobago Government Farm with more bulls buck goats, pigs, and jack donkeys, from the Government Farm.

8. The livestock officer attended an exhibition of livestock owned by the members of the Tobago juvenile farm club at the Government Farm on Saturday, 17th December, 1938. At this show there were exhibited 72 goats, 27 sheep, 29 pigs, 13 cattle, 7 donkeys, 45 fowls, 15 Muscovy ducks, 16 turkeys, and 11 rabbits ; and the Veterinary Officer Dr. T. A. des Iles, and the Inspector of Schools Mr. McAlister, deserve great credit for the good pioneering work done in Tobago in the encouragement of animal husbandry as reflected in the excellent animals exhibited.

9. Towards the close of 1938, by co-operation of the Directors of Agriculture and Education, and the livestock officer, plans were completed for the formation of calf and rabbit clubs at certain schools selected by the Director of Education. Three rabbits were distributed to each of eight schools as follows : two schools at St. Joseph, one school each at Arouca, Arima, Maturita, Manzanilla, Bonne Aventure, and Jordan Hill ; and five heifer calves were sent to each of the following : Tobago, Tacarigua, Warrenville, Caroni and Chaguanas.

10. The Livestock Officer, besides visiting breeding units, and encouraging the breeding and improvement of livestock generally throughout the colony during 1938, spoke to members of district agricultural societies and the public.

11. Pamphlets were prepared during the year on livestock subjects, such as the need for livestock improvement, care and management of dairy cattle, dairy goats, and poultry. Some of these have been published, and others it is hoped will shortly be published.

12. Beginning on the 4th November, and closing on the 23rd December, 1938, five trial shipments of livestock were received from Tobago consigned to the livestock officer in Trinidad by the Veterinary officer. After paying freight, the sum of $242.70 was remitted to Tobago for these five consignments. The animals sold were 5 cattle, 8 pigs, 3 sheep and 1 donkey. The limited experience gained so far goes to show that mature cattle are worth 5 cents per pound live weight, calves 6 cents per pound, and pigs between 8 and 9 cents per pound. The Veterinary Officer in Tobago has expressed satisfaction with the result of the sales, and reports that people in Tobago are gradually gaining confidence in this system of disposing of their livestock, and have expressed their appreciation of Government's efforts to prevent the Tobago stock raiser from losing the profits which formerly went to the speculator or middleman. The Livestock Officer has been licensed as an auctioneer by Government. Animals are sold by auction immediately on arrival from Tobago on the St. Vincent jetty to butchers and others who congregate there on arrival of the Tobago boats. The need for an animal weighbridge both at Tobago and in Trinidad is greatly felt, and it is suggested that this want should be supplied as early as possible.

13. On Saturday, 24th September and 1st October, 1938, " after crop " shows were held for peasants and cane farmers, at Tacarigua, Caroni, Carapichaima, Williamsville, Princes Town, and Debe Settlement. These shows were a great success in spite of the fact that they were very hurriedly organized. It is suggested for the future that these shows should be advertised much earlier during 1939. Further, estate authorities should be encouraged to supplement the Government grant during 1939, in order to ensure even greater success. It is recommended that not more than two shows should be held on any one day, in order to allow the Livestock Officer greater opportunity for encouraging exhibitors of any outstanding prize winners to compete at the annual livestock exhibition of the Agricultural Society. If it could be arranged to offer Trinidad exhibitors the same facilities for the free transportation of animals to and from the annual exhibition, as are now afforded Tobago exhibitors, it should be possible to select a few really outstanding peasants' animals, on the recommendation of the Livestock Officer.

14. It would be a great help to the safe transportation of breeding units, if a properly constructed motor van specially designed for livestock could be imported. Such a van should be large enough to transport four animals (two large and two small) and the stud groom and luggage at a single trip. This van could be used for other purposes besides livestock.

15. The present system of allowing stud fees for breeding units to be retained, in exchange for the feeding and stabling of stud animals, is most unsatisfactory. The stud groom is paid by the Government Farm, and it would be far more satisfactory if the animals were fed, and fees retained, by Government, under the supervision of the Livestock Officer as a connecting link with the Government Farm.

16. On the 12th September, 1938, the Livestock Officer left for Tobago to attend the agricultural and industrial exhibition of the Tobago District Agricultural Society, held at 'The Farm', Tobago, on the 15th and 16th September, and acted as one of the judges in certain sections, and returned to Trinidad on 16th September.

17. The exhibition was a success as far as number of entries, quality of exhibits, and attendance were concerned. With certain improvements in organisation, accommodation for exhibits, and the appointment of a sufficient number of competent stewards, to ensure the placing of exhibits in their proper classes prior to judging, this exhibition can be made a most valuable preliminary to the holding of the a nual livestock exhibition of the Agricultural Society in Trinidad.

18. On the 21st, 22nd and 23rd of October, 1938, the third annual livestock exhibition of the Agricultural Society was held at the race stand, Queen's Park, Port-of-Spain, at which the Livestock Officer rendered the usual assistance. The introduction of classes for the first time, exclusively for peasants, was well patronised by Tobago exhibitors, and by the offering of free transportation to Trinidad peasants also in future, and the extension of the scope of "after crop" shows for peasants and cane farmers, and the introduction of shows for district agricultural societies; the improvement of the annual livestock exhibitions of the Agricultural Society would be assured. The 1938 exhibition was an improvement in entries and quality of exhibits over previous years. The falling of rain on the days of this year's exhibition reduced the number of visitors to the show, and prevented it from being a financial success. It would be in the interests of local animal husbandry to make use of the services of the Livestock Officer for the holding of auction sales, free of charge to exhibitors, at future exhibitions.

19. The holding of a general exhibition in 1940 as proposed, should not be allowed to interfere with the holding of the fourth annual livestock exhibition during this year, nor should any excuse whatever prevent the continuity of these most valuable and almost indispensable aids to the success of the livestock industry of the colony.

J. L. SHANNON,
Livestock Officer.

REPORT OF THE ENTOMOLOGIST FOR THE YEAR 1938.

As in previous years, I continued to occupy laboratory premises at the Imperial College of Tropical Agriculture during the year. This accommodation, however, is now required by the College and arrangements were consequently made for transfer of my division to the Head Office of the Department at the beginning of 1939.

2. I continued to serve as a member of the Plant Quarantine Committee and also attended all the meetings of the Sugar Cane Investigation Committee.

3. Close co-operation was maintained with the Staff of the Imperial College; recommendations were made for control of insect pests of lawns, for the destruction of ants and for rat control, to the College Department of Agriculture and field and laboratory demonstrations of biological control and of the froghopper problem were arranged for students of the College. I also organized a field excursion of students for general study of the local flora and fauna. Acknowledgment is due to Dr. T. G. Mason and the staff of the Physiology Department of the Cotton Research Station for valuable advice and assistance throughout the year.

Sugar Cane.

4. Breeding and distribution of the Amazon Fly were continued and liberations have now been made in most parts of the sugar producing area. Recoveries of this insect have been made in the field from time to time, but definite establishment of the parasite is still in some doubt. A definite investigation of the situation is to be made in 1939.

5. The year 1938 was remarkable for heavy rainfall and for a dry season precipitation well above the average. Weather conditions have had an important bearing upon froghopper incidence which was, in the main, in accordance with the theories formulated by Mr. C. B. Williams and by the writer.

6. In northern districts, first brood attack was widespread and relatively severe but, owing to the rapid multiplication of fungus enemies of the pest, the second and third brood outbreaks were comparatively small. The occurrence of the principal injury early in the year allowed opportunity of good recovery of the attacked fields. In southern areas, the position was different and, according to reports received, the attacks of froghopper were not serious until late in the year, when a rather large third brood outbreak occurred. Some 3,000 acres of cane were affected by blight, 1,100 acres being severely damaged.

7. Investigations were continued on insecticidal control of the froghopper and large scale experiments were conducted at Woodford Lodge Estate. Acknowledgment is due to the Sugar Technologist for valuable assistance in this work. A power dusting machine was purchased early in the year and was employed to distribute pyrethrum dust over entire fields. It was found that, in general, every part of a ten acre block of canes could be treated by this machine from the traces, but that distribution of the dust was rather uneven. Some minor difficulty was also experienced through changes in the direction of the wind while dusting was in progress, but on the whole, distribution in this manner was satisfactory.

8. The pyrethrum used was an impregnated dust containing 0.4 per cent. pyrethrins. For use in the duster, the material was mixed with varying proportions of hydrated lime as a carrier. An alkaline carrier, such as lime, is somewhat unsuitable for work with pyrethrum and was only employed because of its ready availability in a finely divided state. It is unlikely that the experimental results were markedly affected by this but, as finely divided clay is now obtainable in the colony, this material will be employed as a diluent in future work.

9. The results obtained were encouraging. Using 8.9 pounds of pyrethrum per acre, an average mortality of 44 per cent. of the adult froghoppers present was obtained. When the application was increased to 14.4 lb. per acre, 64.7 per cent. mortality resulted. The cost of insecticide employed to produce this mortality amounted to $3.76 per acre, using pyrethrum at £112 per ton and lime at 1c. per pound. From prices recently quoted, it should be possible to reduce this cost appreciably and, judging by the analysis, certain preparations should be capable of giving a satisfactory mortality at a cost of between $1 and $1.50 per acre. Trial of such products will be made during 1939.

10. It is believed that the most satisfactory results will be obtained by concentrating control work on the first brood, which, in most years, has a limited distribution, thereby avoiding the necessity for treating the very large areas which an uncontrolled second brood usually attacks.

11. Investigations of the varietal resistance of sugar cane to froghopper attack were continued by Messrs. Callan and Fennah of the Imperial College of Tropical Agriculture. Decisive results from this experiment are extremely difficult to obtain owing to the uncertainty of distribution of the main froghopper broods, in consequence of which it is impossible to ensure that the experimental canes will be attacked. In 1938, certain of the plots were entirely free from froghopper attack and in all others, froghopper incidence was slight. So far as the results go, however, they support the findings of previous years and seedling crosses which, from stomatal counts were expected to be resistant, have behaved according to expectation.

Cocoa.

12. Cocoa thrips was not much in evidence during the greater part of the year, but populations in many districts mounted with great rapidity after the middle of October. By December, damage was severe in several districts, particularly in the Sangre Grande and Montserrat districts.

13. Studies on the cocoa thrips were continued throughout the year in observation plots at Brasso. There still appears to be little connection between variation in the physical environment and fluctuations in insects numbers, nor does a "change of leaf" during the wet season appear to influence thrips populations to a marked degree. Populations increased most rapidly in 1938, however, when conditions were becoming less humid. The data collected show that there is normally a heavy mortality of nymphs, only a small proportion of which ordinarily survive to the adult stage. A sudden increase in thrips populations is accompanied by an increase in the proportion of adults, indicating that at least a part of population increment is due to increased survival of development stages. Routine work in the experimental area and careful observations in other districts show that the cocoa thrips can be found in all areas and at all times of the year, even in spots where serious attack is seldom or never experienced.

14. Experiments on the control of vermin in cocoa plantations by means of poisoned baits were continued. Dry copra, poisoned with strychnine "matches" was found to check losses due to squirrel injury and on one estate, losses due to the combined activities of rats and squirrels were reduced from 50 per cent. of the pods to 15 per cent. by the use of bananas poisoned with phosphorus matches and copra poisoned with strychnine.

15. Losses due to squirrels remain a serious problem and, while it now appears certain that control may be effected by the use of poison baits, strychnine is much too dangerous a substance for general use in this connection. Further studies will be devoted to trials with less objectionable material.

16. Free distribution of sulphur matches to cocoa planters was discontinued in 1938; stocks were maintained for sale at the cost price of one cent per box. The demand was disappointingly small and shows that the campaign against rats has already been abandoned by most proprietors. Information from the District Staff indicates that the rat plague may be recurring in certain districts.

Citrus.

17. Owing to abnormally wet weather conditions in the early part of the year, flower and fruit setting of grapefruit was very erratic and in place of the usually well-defined flower flush, a series of minor flushes took place, extending over several months. Experiments which had been projected, for investigation of rust mite control and of the control of scab disease had to be abandoned on that account.

18. Rust mite remains the most serious and widespread pest of grapefruit in the colony. Scale insects, which are usually of little importance in Trinidad, were even less in evidence in 1938 than in previous years. Scab disease (*Elsinoe fawcetti* Jenk.) was found to be far more widespread in the colony than had previously been suspected. The disease is now recorded from Santa Cruz, Maraval, Diego Martin, Arima, Cunupia, Chaguanas, Cumuto, Tamana, Guaico, Manzanilla, Williamsville and Erin. Santa Cruz remains the area of most serious infestation.

19. Scientific investigation of scab disease has been carried out by Mr. R. E. D. Baker of the Imperial College of Tropical Agriculture with whom I am co-operating and details have been drawn up for a fairly large-scale spraying experiment to be conducted in 1939 to ascertain the possibility and cost of commercial control of the disease. In connection with this work, a power spray rig has been purchased by the Department. From Mr. Baker's observations on the disease and from experience abroad, notably in Puerto Rico, it is probable that economic control of the disease may be effected by suitable spray treatment. I believe further than if large-scale spraying is generally adopted, control of other pests and diseases, which at present are responsible for fairly serious losses, may also be controlled with little or no additional expense.

20. Identifications have been received of insects collected in the fruit fly survey, mentioned in paragraph 13 of my report for 1937. The fruit flies collected comprise: *Anastrepha striata* Schin., *A. serpentina* Wied., *A. mombinpraeoptans* Sein and *A. distincta* Greene; the last mentioned is a new record for Trinidad. I am indebted to Dr. Alan Stone of the United States Bureau of Entomology and Plant Quarantine for his study of this material. Further collections are being made and there is still no evidence of the presence of the Mediterranean Fruit Fly (*Ceratitis capitata*) in Trinidad.

21. For some years, a number of grapefruit and oranges have shown signs of injury resembling that caused by fruit flies. In 1935-36, I was able to show that nearly all this injury was caused by a lepidopterous larva. Since that time, damage of this nature has been of little importance, but sufficient material was obtained in 1938 to breed a series of adult moths which were forwarded to the Imperial Institute of Entomology for identification. The insect in question is stated to be "*Laspeyresia* sp., near *rhodaspis* Meyr."

22. A system of quarterly inspections of citrus trees at St. Augustine Experiment Station was instituted, designed to give detailed information on the status of scale insects as pest of this crop. The records show that the severity of attack, not serious even at the beginning of the year, declined progressively during the wet season until, in December, the number of infested trees was only about half the number in the preceding January; the degree of infestation of individual trees also declined in this period. It is of interest to note that, in the case of the manurial experiment, no relation between manurial treatment and abundance of scale insects can be detected by critical examination of the data. The general severity of scale attack at the Experiment Station has been greatly reduced since 1935; this appears to be due chiefly to the establishment of permanent windbreaks of *Glyricidia*, which are now sufficiently well-grown to be effective. These observations apply equally to *Prontaspis citri* (orange snow scale) *Lepidosaphea beckii* (purple scale) and *L. gloveri* (Glover's scale).

23. An examination of limes affected by a disease was made at Cedros. The symptoms, taking the form of progressive yellowing of the foliage followed by death of the whole or part of the tree appear to be due to a complex of unfavourable physiological conditions known as "collar canker" and are induced by abnormally wet soil and lack of mineral nutrients. The immediate cause of failure is a decay of the cortical stem tissues at or below soil level and the advanced lesions closely resemble mechanical injuries. It is probable that the disease occurs elsewhere but it is mistaken, where it occurs sporadically, for injury by deer. Incidence of the disease at Cedros was probably due to the heavy rainfall of 1938.

Bananas.

24. Owing to an increase in the number of banana bunches for shipment which were rejected at the wharf, further attention was paid to the problem of scarring. Blemishes taking the form of minute raised "pimples" on the surface of the fruit are universally present on bananas in Trinidad; in a proportion of cases, these are so numerous as seriously to disfigure the bunches and to render them unfit for shipment. The Canadian recipients stated that the blemish was associated with premature decay of the fruit. A number of severely affected bunches, rejected at the Wharf, were accordingly handed over to the Low Temperature Station at the Imperial College of Tropical Agriculture, where they were subjected to a period of cold storage and were subsequently ripened; the treatment was a close approximation to that given to commercial shipments. In no case was any injury to the edible portion of the fruit noted.

25. Examination of sections through the blemishes showed that they never extended deeper than about half a millimetre in the skin, irrespective of the maturity or condition of the fruit. It is certain, therefore, that this form of injury, whether mild or severe, does not affect the edibility of the fruit, and its apparent association with a fruit rot must have been entirely fortuitous.

26. A similar type of injury in St. Vincent was described by Mr. Squire, Entomologist to the Imperial Department of Agriculture, who attributed it to several species of thrips of the genus *Frankliniella*. A species of *Frankliniella* is also responsible for the damage in Trinidad. The injury is caused by attempts at oviposition by the adult female, when the hand of bananas is still ensheathed in its bracts. This results in the formation of a minute pit in the skin, of the form of an inverted cone; the cavity rapidly fills with latex which becomes brown or black on oxidation and the seat of injury becomes slightly swollen during subsequent growth of the fruit. Successful oviposition in these circumstances does not appear to be possible in Trinidad, but Squire found eggs regularly at the bottom of the holes in St. Vincent.

27. The thrips responsible for the injuries appears to frequent flowers of many species and no suggestions for its control can yet be made. As a cause of rejection, the injury is probably of minor importance, but any increase in severity would occasion serious loss.

28. Scarring by mammals remains a major cause of the rejection of bunches and could be reduced by determined action. It is probable that intensive use of poison baits would have speedy results at small expense.

Stored Products.

29. Experiments on the storage of maize were continued and trial was made of a specially designed bin for the purpose. This consists of a cylinder of galvanised iron, tapering to a cone at the lower end, which is fitted with a trap through which grain can be withdrawn as required. The top of the bin is open, but the grain is covered with a layer of fine, dry sand separated from the corn by a layer of cloth. The trap is made insect proof by surrounding it with a box of dry sand. As grain is withdrawn from below, the remainder of the grain in the bin sinks together with its covering of sand, and withdrawals can thus be made without breaking the insect-proof seal. A bin of this type, holding about 500 lb. maize can be made locally at a cost of about $5.00 or less.

30. In the course of the experiments, local grain, dried to 11 per cent. moisture content was stored in the bin. The grain was fumigated with carbon bisulphide for 24 hours, turned to expel residual vapour of the fumigant and was then replaced in the bin and covered with sand. Small samples were withdrawn from time to time for examination. It was found that the grain slowly absorbed moisture from the air, but the moisture content became fairly stable after about two months, when it fluctuated between 11.9 and 12.3 per cent. After five months, the grain was withdrawn and examined. No sign of damage from insects or fungi could be detected; when the grain was subsequently sold, it commanded the maximum price and 100 per cent. of the grains germinated in each of six tests.

Miscellaneous Pests.

31. Watermelons in the Debe district suffered from severe attacks of *Aphis gossypii*; these insects could be rapidly and economically destroyed by oil emulsions, pyrethrum extract or "Derrisol" but, owing to severe floods which inundated the area, the bulk of the crop was destroyed before control measures were put into effect. The gardeners of this district are now fully aware of the necessity for spraying their crops and they have jointly raised subscriptions for the purchase of simple equipment and the necessary insecticides. This is an example which might be followed with advantage in other districts.

32. Papaws were found to be attacked by the papaw fruit fly, *Toxotrypana curvicauda*, at Toco, Tunapuna and elsewhere. Varieties with a thick flesh appear to escape attack, but the losses are severe whenever this crop is grown for sale and the replacement of susceptible plants must necessarily be a slow process owing to the heterogeneous and undefined types which are propagated. Experiments with bait traps have been commenced.

33. Mole crickets caused serious injury to lawns in most districts. Satisfactory control of these and other lawn pests, including chinch bugs, cutworms and ants was obtained by watering the affected patches freely with diluted pyrethrum extract. This method is somewhat expensive, but has a decided advantage in domestic gardens as it avoids the use of poisons and the attendant risk to children, domestic animals and birds. The Curator of the Royal Botanic Gardens has had considerable success in destroying mole crickets on a large scale by means of a proprietary arsenical preparation.

Insect problems in Grenada.

34. A visit was paid to Grenada from the 9th to the 15th of November in connection with insect pests in that colony. Sugar cane was found to be suffering from the attacks of froghopper and of *Diatraea*. Large scale trial of Cyanogas for the control of the former pest in 1939 was recommended. While the cane affected annually by froghopper in Grenada represents a significant proportion of the crop, the total area attacked is small and it is probable that, on this account, a method of control which was found to be somewhat unwieldly in Trinidad, may be practicable in Grenada.

35. *Diatraea* spp. are the most destructive pests of cane in Grenada, where the joint infestation is in the neighbourhood of 15 per cent. Importation of the Amazon Fly parasite (*Metagonistylum minense*) was recommended.

36. Locally severe outbreaks of the cocoa thrips afforded an opportunity for investigation of the status of the parasite (*Dasyscapus parvipennis*) introduced some years ago. Over 8,000 thrips were examined in detail, but there was no sign of parasitism, nor were any free parasite pupae discovered.

38. The cocoa beetle (*Steirastoma depressum*) remains the most important pest of cocoa in Grenada and it is unfortunate that the depression of the industry has necessitated relaxation of control measures.

39. Cocoa is also subject to attack by a termite (*Calotermes* sp.) which causes serious injuries to living tissues. The difficulty of recognising affected trees before irreparable damage has been done makes control extremely difficult.

40. Limes were found to suffer severely from scale insect attack and details were given of inexpensive methods of control by the use of insecticides. The weevil *Diaprepes abbreviatus* var. *comma* occurs on limes in Grenada, but it is by no means abundant and, so far as my own observations go, it appears to cause little injury.

Lectures and Addresses.

41. Addresses were given to the following bodies :—
East Indian Welfare Association, Debe. (Spraying for Pest Control.)
Cultivation Sub-Committee of the Sugar Manufacturers' Association. (Control of the Sugar Cane Froghopper by Power Dusting.)
Grenville (Grenada) Peasants Improvement Association. (Crop Storage.)
Grenada Agricultural Association. (Pests and Diseases of Citrus.)

Publications.

42.—(1) Entomological Contributions to the Study of the Sugar Cane Froghopper. III. Observations on the Biology of certain Neotropical Species of *Tomaspis*. (*Tropical Agriculture*, Vol. XV, No. 3, pp. 56-65.)

(2) A note on Pyrethrum as a Possible Insecticide for the Control of the Sugar Cane Froghopper. (*Loc. cit.*, No. 4, pp. 75-76.)

(3) Insecticides for the Control of certain Trinidad Crop Pests. (*Loc. cit.*, No. 6, pp. 126-131.)

ALAN PICKLES,
Entomologist.

REPORT OF THE SUGAR-CANE AGRONOMIST FOR 1938.

The scope of the work in Trinidad during 1938 may be conveniently summarised under the following headings :

(1) Experiments with Manures.
(2) Experiments with Cultural Methods.
(3) Experiments with Planting Methods.
(4) Experiments with Varieties.
(5) Biochemical Investigations.
(6) Soil Investigations with special reference to Manurial Treatment.
(7) Soil Survey with special reference to the Allocation of Varieties
(8) Miscellaneous.
(9) Publications.

2. The number of manurial, cultural and varietal trials which have been reaped by my Division during the period 1934-39 is recorded in Table I.

Table I.—Field experiments harvested in Trinidad during the period 1934-39.

Year.	Manurial.	Cultural.	Varietal.	Total.
1934	32	8	—	40
1935	38	9	—	47
1936	56	10	—	66
1937	51	11	8	70
1938	36	5	14	55
1939*	*37	9	20	66

* To be harvested.

The experimental scheme was initiated in 1927 on the Ste. Madeleine Estates with one experiment. During the period 1928-1936 the number of experiments increased rapidly, all sugar estates being gradually included in the scheme. Since 1936 the number has remained approximately stationary, with fluctuations from year to year depending on such factors as complexity of experiment, weather conditions, &c. Varietal experiments were first placed in my charge in 1936, and are rapidly taking a very prominent place in the experimental scheme.

3. Details as to the nature of the manurial, cultural and varietal trials in operation are published at the end of each year by the Sugar-Cane Investigation Committee.

1. EXPERIMENTS WITH MANURES.

4. Thirty-six field experiments with lime, nitrogen, potash, phosphate, by-products (pen manure, molasses, megasse and filter-press mud) and auxiliary elements (copper and manganese) were harvested during the dry season of 1938. The results of these experiments have been set out in detail in my *Annual Report for* 1938 *on Field Experiments on Sugar-Cane in Trinidad* (pp. 4-79) which has been published by the Sugar-Cane Investigation Committee. The main conclusions to be drawn from the experiments are outlined below.

Lime.

5. The permanent liming experiments on Caroni and Waterloo Estates were replanted in 1937 and consequently were not reaped this year. They will be again harvested as plant canes in 1939.

6. In 1936 it was found that a larger gain in yield of plant canes was obtained by applying ground limestone after instead of before ploughing. Indications have now been obtained that the greater beneficial effect of the later application may in certain circumstances persist to the ratoon crops.

7. The residual gain in yield of cane resulting from a dressing of coarse limestone has again been shown to be small when the rainfall during the life of the crop is not excessive (*see* my Annual Report for 1937).

8. Small dressings of ground limestone applied around the stool at the time of planting, to neutralise harmful effects of the acidity developed during nitrogen transformations in the soil, have not been found to have immediate or residual beneficial effect on yield of cane.

Nitrogen.

9. Studies on the effects of size and time of application of dressings of sulphate of ammonia on yield of plant canes have been continued. Small dressings of sulphate of ammonia *at planting* have been found to give paying gains in yield on soils very deficient in immediately available nitrogen but not on more fertile soils. The optimum total dressing of sulphate of ammonia to plant canes has been found in general to vary from 4 to 6 cwts. to the acre, divided into two approximately equal doses applied six to eight weeks after planting and during the dry season following planting. On the soils of lowest fertility it is likely that total dressings in excess of 6 cwts. could be applied with advantage.

10. Additional evidence has been obtained to the effect that on acid soil dressings of sulphate of ammonia to plant canes can have a beneficial residual effect on the yield of the following ratoon crop.

11. A dressing of 2 cwts. of sulphate of ammonia to the acre has now been found to supply adequate nitrogen to ratoon canes on the most fertile soils. In general, however, a dressing of 3 cwts. is required.

12. Experiments conducted for a number of years on unpenmanured areas of the marl and red-weathering clay soils of the Naparima District have so far given no indications that the beneficial effects of sulphate of ammonia on yield of cane are diminishing as a result of regular annual application to successive crops. One example is recorded in Table II.

Table II.—Effects of continued applications of sulphate of ammonia to successive crops. (Ste. Madeleine Estates.)

S/A per acre in 1931, in 1932, in 1933, in 1934, in 1935 and in 1936.	Gains in yield of Uba cane (ton per acre).					
	1st R. (1932)	2nd R (1933)	3rd R. (1934)	4th R. (1935)	5th R. (1936)	Plants (1938)
1½ cwts.	4.12	4.57	4.25	3.55	4.28	3.22
3 cwts.	6.23	7.37	7.92	8.06	8.30	6.66
4½ cwts.	7.15	9.22	9.47	10.05	9.28	7.91
Average gain	5.83	7.05	7.21	7.22	7.29	5.93

13. Additional proof has been obtained that on potash-deficient soils maximum gains in yield of plant canes and ratoons cannot in general result from dressings of sulphate of ammonia unless potash also is applied.

14. On an area of alluvial soil it has been shown that a dressing of phosphate can depress the gain in yield of cane which may result from increasing the size of dressing of sulphate of ammonia. In certain circumstances this adverse effect of phosphate can be counteracted by treatment with potash. By contrast, on an area of red-weathering clay soil, phosphate has not been found to have significant effect on the gain in yield of cane resulting from heavier applications of sulphate of ammonia.

15. On a soil of low fertility the varieties B. 726 and Co. 213 have been found to give significantly greater response than Uba in yield of cane to heavier dressings of sulphate of ammonia. The response of B.H. 10(12) was found to be smaller than B. 726 and Co. 213 but greater than Uba (Table III).

Table III.—Differential response of varieties to size of dressing of nitrogen (Waterloo Estate).

Variety.	Yields of cane tons per acre.								
	Plants (1936)		1st R. (1937)		2nd R. (1938)		Total Yield.		Total gain.
	N_2	N_1	N_2	N_1	N_2	N_1	N_2	N_1	N_2-N_1
B.H. 10(12) ...	38.43	38.11	26.35	23.67	17.07	14.81	81.85	76.59	5.26
B. 726 ...	44.06	41.15	26.95	25.22	20.40	16.69	91.41	83.06	8.35
Uba	39.33	39.33	27.28	29.11	29.02	27.89	95.63	96.33	—0.70
Co. 213 ...	40.22	37.87	32.96	30.80	30.01	25.93	103.19	94.60	8.59

The treatments with sulphate of ammonia to the acre were as follows :—

N_1—4 cwts. sulphate of ammonia as plant canes (1934-36).
2½ cwts. sulphate of ammonia as first ratoons (1936-37).
2½ cwts. sulphate of ammonia as second ratoons (1937-38).

N_2—8 cwts. sulphate of ammonia as plant canes (1934-36).
5 cwts. sulphate of ammonia as first ratoons (1936-37).
5 cwts. sulphate of ammonia as second ratoons (1937-38).

The four varieties under comparison are those most widely grown in Trinidad.

16. In an experiment on an alluvial soil of the Naparima District little difference has been found in the immediate and residual gains in yield of cane resulting from treatment with sulphate of ammonia (whether in the presence or absence of a small dressing of ground limestone) and from treatment with cyanamide. The manures were buried in the furrows when the banks were broken

Potash.

17. Additional information is now available as to the relationship between the amount of exchangeable potash present in the soil and the optimum manurial treatment with potash of plant canes and ratoons (*see* paragraphs 78 to 82).

18. On one area a measure has been obtained of the rate of increase of the response in yield of sugar cane of the variety B.H. 10(12) to manurial treatment with potash over a period of five successive crops (Table IV).

Table IV.—Increase with successive crops of response in yield of cane to potash (Caroni Estate).

Crop.	K_2O per acre.	Gain from potash (tons cane per acre).
Plant canes (1932)	150 lb.	1.13
First ratoons (1933)	150 lb.	1.70
Second ratoons (1934)	150 lb.	2.01
Plant canes (1936)	265 lb.	6.43
First ratoons (1937)	265 lb.	5.07

19. On a potash-deficient soil paying gains in yield have been shown to result from application of potash to four successive crops. On such soils it would appear necessary to continue to apply potash for an indefinite period.

20. Further evidence has been obtained to the effect that the presence of adequate available nitrogen is necessary to ensure maximum gain in yield of plant canes and ratoons from treatment with potash.

21. On an alluvial soil it has been confirmed that in certain circumstances treatment with phosphate can depress the gain in yield of ratoon canes resulting from a dressing of potash unless an unusually heavy dressing of nitrogen is applied.

22. On a calcareous marl soil of the Naparima District potash has been found to give a large gain in yield of plant canes provided phosphate also is applied. On a comparable non-calcareous soil sugar cane would not respond to treatment with potash. It has previously been shown that potash can give rise to greater gains in yield on limed than unlimed soils.

23. The red-weathering clay soils of the Naparima District do not appear in general to give paying responses in yield to dressings of potash.

24. The variety B.H. 10(12) has been shown to give significantly smaller response in yield to potash than B. 726, Uba or Co. 213 on a soil of low fertility (Table V).

Table V.—Differential response of varieties to potash (Waterloo Estate).

Variety.	Yields of cane (tons per acre).								
	Plants (1936).		1st R. (1937)		2nd R. (1938)		Total.		
	Potash.	No potash.	Potash.	No potash.	Potash.	No potash.	Potash.	No potash.	Diff.
B.H. 10(12) ...	40.69	35.86	26.07	23.95	16.86	15.00	83.62	74.81	8.81
B. 726	46.64	38.58	28.31	23.86	21.80	15.29	96.75	77.73	19.02
Uba	44.11	34.55	31.13	25.27	31.74	25.17	106.98	84.99	21.99
Co. 213	42.14	35.95	34.32	29.44	31.65	24.29	108.11	89.69	18.42

Phosphate.

25. Progress has been made in determining the sugar-cane areas which respond to phosphate.

26. Paying gains in yield of plant canes or ratoon canes, or both, have been obtained as a result of treatment with superphosphate on various areas of alluvial soil.

27. On one of these areas it has been shown that a very small dressing of phosphate is ample for the needs of plant canes and that an adequate dressing of potash is essential to derive full benefit from the phosphate. The effect of size of dressing of nitrogen, within the limits investigated, on the gain from phosphate appeared unimportant in comparison with the effect of potash.

28. On the red-weathering clay soils of the Naparima District phosphate has given rise to paying gains in yield of plant canes in three out of five experiments. In one of the successful experiments a dressing of potash was found essential to ensure the beneficial effect of phosphate if a heavy dressing of nitrogen was applied. Phosphate failed to give rise to a gain in yield of ratoon canes in one experiment on this type of soil.

29. On a calcareous marl soil of the Naparima District treatment with superphosphate led to a significant loss in yield of plant canes in the absence of applied potash and to a paying gain in the presence of potash. The interaction of phosphate with potash could not be shown to be dependent on the size of dressing of nitrogen within the limits investigated. Phosphate had no appreciable effect on the yield of first ratoons in this experiment.

30. It has previously been shown that response in yield of sugar cane to phosphate is dependent on a number of factors which may include the lime, nitrogen and potash status of the soil.

By-products as Manures.

31. *Pen Manure.*—Additional evidence is provided to the effect that the immediate and residual gains in yield from treatment with pen manure can be reduced to a very small value in the presence of inorganic manure.

32. *Molasses.*—In an experiment on a red-weathering clay soil of the Naparima District dressings of molasses of two or more pints to the stool were found to increase the yield of plant canes of variety Uba. One pint of molasses to the stool was found to have a small and doubtful beneficial effect on the yield of plant canes of variety B. 726 on a calcareous marl soil.

33. *Megasse.*—A dressing of megasse, buried in the furrows when banks were broken, had no beneficial effect on the yield of plant canes of variety B. 726 on a calcareous marl soil, whether applied in the presence or absence of molasses.

34. *Filter-press mud.*—Dressings of filter-press mud, in excess of 4 tons to the acre, on a red-weathering clay soil were found to lead to a well-defined gain in yield of plant canes of variety B. 726.

Auxiliary Elements.

35. Preliminary measures have been obtained of the effects on yield and juice quality of plant cane of soaking the setts before planting in solutions of copper and manganese sulphates The experiments were carried out on the red-weathering clay and marl soils of the Naparima District.

2 EXPERIMENTS WITH CULTURAL METHODS.

36. Five cultural experiments dealing with drainage, mulching and tillage problems were reaped in 1938. The results of these experiments are set out in detail in my *Annual Report on Field Experiments on Sugar Cane in Trinidad for* 1938 (pp. 80-86)

Drainage

37. Deepening the drains on a silty-clay soil from 12-14 inches to 28-30 inches between beds of standard width (22 feet) has been shown to result in definite gains in yield of plant canes and first ratoons. The experimental area was ploughed to a depth of 12-14 inches before planting.

Mulching with Megasse.

38. In experiments with the variety B.H. 10(12) on red-weathering clay soils of the Naparima District it has been shown that mulching the soil with megasse can give rise to an appreciable gain in yield of plant canes provided that—

(i) the mulch is applied to the young plants before the advent of the dry season. No immediate gain in yield may result if the mulch is added after the topsoil has begun to dry out;

(ii) the plant canes are given a suitable second-season dressing of sulphate of ammonia as well as an early dressing of this manure. The moisture conserved by the mulch may have little effect unless adequate nitrogen is available.

39. It has also been shown that mulching with megasse may have an appreciable beneficial residual effect on the yield of first ratoons. The immediate and residual gains from mulching were found to be slightly larger when the megasse was applied within as well as around the plant-cane stools. This finding is important for it is easier and less expensive to broadcast the mulch than to restrict its application to the area between the stools.

40. Young plant canes and ratoons of the variety B.H. 10(12) suffer severely from drought during the dry season on red-weathering clay soils of the Naparima District. In consequence these soils are planted at present in less desirable but more hardy varieties. The data obtained suggest that in many cases a noble variety of cane could be satisfactorily grown if it is possible successfully to introduce mulching as a standard estate operation.

Tillage of Ratoons.

41. Confirmatory evidence has been obtained to the effect that in general annual forkings have no immediate or cumulative beneficial effect on the yield of ratoon canes provided that the soil is satisfactorily ploughed before planting. On the contrary, forking may lead to loss in yield of cane in certain circumstances.

3. EXPERIMENTS WITH PLANTING METHODS.

42. Four experiments concerned with the spacing of plants were harvested in 1938. The results are set out in detail in my *Annual Report on Field Experiments* (pp. 87-92).

43. On a red-weathering clay soil and on an alluvial soil of the Naparima District it has been found that significantly larger yields of plant and ratoon canes may be obtained by planting six pairs of cane setts, rather than four pairs, in the furrows across beds 22 feet in width. On the alluvial soil, but not on the red-weathering clay, still larger yields resulted from planting eight pairs of setts in the furrows. The effect of spacing distance in the furrow was not found to be dependent on the size of dressing of manure within the limits investigated

44 On a marine swamp clay, and on a transitional soil, of the Caroni District large yields of crop plants, but not of ratoons, were found to result from planting six pairs of cane setts, than from a single continuous row of setts, in the furrows across the beds. In these experiments the plant canes but not the ratoons, were irrigated.

4. EXPERIMENTS WITH VARIETIES.

45. Sixteen different varieties of sugar cane were under comparison in experiments reaped in 1938 (my *Annual Report on Field Experiments*, pp. 93, 120). The information obtained together with the data secured in previous years, suggest the conclusions outlined below.

B 726.

46. The variety B. 726 can give excellent results on the deep marl soils of the Ste. Madeleine Estates. On these soils it is probably superior to the standard variety B.H. 10(12) both as plant canes and ratoons.

47. B. 726 appears more suited than B.H. 10(12), Uba or Co. 213 to an area of degenerated loam soil of the Waterloo Estates. On this soil it would appear preferable to replant after reaping the first ratoons rather than to allow B. 726 to ratoon a second time.

48. On soils other than the deep marls of the Ste. Madeleine Estates, and the area of the degenerated loam in the Waterloo Estates, plant canes and ratoons of the variety B. 726 do not appear to give as large yields of sugar as B.H. 10(12).

49. It would appear that B. 726 cannot be relied upon to give juice of superior quality to B.H. 10(12) early in the reaping season if weather conditions are unfavourable for ripening.

Co. 213.

50. The variety Co. 213 has been found to give a ton of sugar more to the acre as plant canes than the standard variety Uba on the red-weathering clay soils of the Ste. Madeleine Estates. It may be found advisable to replace Uba by Co. 213 on this important and extensive type of soil.

51. Co. 213 has given somewhat smaller yields of sugar as plant canes and ratoons than B. 726, but larger yields than B.H. 10(12) and Uba on a degenerated loam in the Waterloo Estates. It has also given a poorer yield of sugar as plant canes than F.C. 916 on a soil of intermediate fertility at Orange Grove Estate.

52. Co. 213 gave a larger total yield of sugar as plant canes and ratoons than B. 39 when reaped late in the season, but a smaller total yield when reaped early, at Woodford Lodge Estate.

Co. 290.

53. The variety Co. 290 has been found to give a larger total yield of sugar as dry-season plants and first ratoons than B.H. 10(12) and P.O.J. 2878 on the marine swamp clays of Caroni Estate. Co. 290 shows promise of becoming the standard variety on these soils and is worthy of extended trial.

54. Co. 290 appears to possess juice of superior quality to Co. 213 on areas of intermediate fertility on the Waterloo Estates which are at present planted in the latter variety. Co. 290 merits further trial on such areas.

F.C. 916.

55. Plant canes of the variety F.C. 916 have been found to give larger yields of sugar than B.H. 10(12) on soils of intermediate fertility at Orange Grove Estate and Esperanza Estate. This variety is worthy of extended trial on such soils for late reaping in the crop season.

56. F.C. 916 appears to be slightly inferior as plant canes in yield of sugar to B.H. 10(12) on the marl soils of the Ste. Madeleine Estates

Diamond 10.

57. The variety Diamond 10 has given excellent results as plant canes when reaped either early or late in the crop season on an area of Esperanza Estate which it is difficult to drain satisfactorily. This variety is worthy of extended trial under conditions of this nature.

58. Comparatively poor yields of sugar were given by Diamond 10 as plant canes and ratoons on a fertile alluvial flat in the Ste. Madeleine Estates.

P.O.J. 2878.

59. The variety P.O.J. 2878 has been found superior to B.H. 10(12) as plant canes and ratoons for reaping late in the crop season on a fertile alluvial flat in the Ste. Madeleine Estates.

Merthi, Oshima and Kavengire.

60. The varieties Merthi, Oshima and Kavengire have been found less satisfactory as plant canes on the red-weathering clay soils of the Ste. Madeleine Estates than the standard variety Uba.

M.P.R. 28, M.P.R. 42, Co. 281 and P.O.J. 36.

61. It is doubtful whether the varieties M.P.R. 28, M.P.R. 42, Co. 281 and P.O.J. 36 are suited to the conditions which obtain in Trinidad.

5. BIOCHEMICAL INVESTIGATIONS.

Crop Quality.

62. Whenever possible juice analyses have been made of the canes from the plots of the experimental areas. The main conclusions to be drawn from the accumulated data are outlined below.

Lime.

63. It has been further confirmed that under moisture conditions unfavourable to ripening a dressing of ground limestone can have an adverse effect on juice quality and that the magnitude of the adverse effect may be dependent on the size of the dressing.

Nitrogen.

64. On an area of red-weathering clay soil it has been found that improvement in juice quality of plant canes of variety Uba can result as the size of the first-season dressing of sulphate of ammonia is increased to 3 cwts. to the acre, and that a first-season dressing larger than 3 cwts. can depress juice quality.

65. In one experiment the adverse effects of heavy dressings of sulphate of ammonia on juice quality were not found to differ significantly with variety of cane. The varieties under comparison were B.H. 10(12), B. 726, Uba and Co. 213.

Potash.

66. On potash-deficient alluvial soils it has been shown that treatment with potash can lead to well-defined improvement in juice quality and to a considerable reduction in the amount of cane required to make a ton of sugar. Improvement in juice quality on such soils cannot be invariably relied upon as a result of potash manuring, however.

67. On a potash-deficient alluvial soil it has been shown that the beneficial effects of potash on crop quality and yield of sugar can be much greater in the presence than the absence of applied nitrogen, *i.e.* potash tends to counteract any adverse effect of nitrogen on quality.

68. On red-weathering clay soils of the Naparima District treatment with potash (in the presence of sulphate of ammonia) has not been found in general to have a beneficial effect on juice quality.

69. On an alluvial soil the variety B.H. 10(12) has been shown to give significantly smaller response in yield of sugar to potash than the varieties B. 726, Uba and Co. 213 (Table VI).

Table VI.—Differential response of varieties to potash (Waterloo Estate).

Variety.	Yields of cane (tons per acre).								
	Plants (1936)		1st R. (1937)		2nd R. (1938)		Total.		
	Potash.	No potash.	Potash.	No potash.	Potash.	No potash.	Potash.	No potash.	Diff.
B.H. 10(12) ...	4.29	3.61	3.07	2.90	2.05	1.80	9.41	8.31	1.10
B. 726	5.04	4.30	3.54	2.91	2.71	1.90	11.29	9.11	2.18
Uba	3.48	3.00	3.37	2.70	3.46	2.64	10.31	8.34	1.97
Co. 213	3.98	3.02	3.80	3.24	3.34	2.58	11.12	8.84	2.28

70. A comparative measure of the response in juice quality of the varieties Co. 213 and Co. 290 has been obtained.

Phosphate.

71. In one experiment on the red-weathering clay soils a dressing of phosphate (in the absence of potash) was found to have a beneficial effect on the juice quality of plant canes. In a second experiment phosphate had a beneficial effect on the juice quality of plant canes in the absence of applied potash and an adverse effect in the presence of potash. In a third experiment on this soil type, on ratoon canes, phosphate led to an improvement in juice quality whether or not potash was applied. On the red-weathering clay soils it would appear that phosphate can have a beneficial effect on juice quality without necessarily affecting the yield of cane, and in certain circumstances can counteract any adverse effect of heavy applications of nitrogen.

72. In an experiment on the calcareous marl soil of the Naparima District a dressing of phosphate (in the absence of potash) had a beneficial effect on the juice quality of plant canes.

By-products as manures.

73. *Pen manure.*—Another example has been obtained of the adverse effect which a dressing of pen manure can have on the juice quality of plant canes.

74. *Filter-press mud and molasses.*—Dressings of molasses and of filter-press mud have also been found to have adverse effects on the juice quality of plant canes.

75. *Megasse.*—A dressing of megasse has been found to have a small adverse effect on the juice quality of plant canes.

Auxiliary elements.

76. Measures have been obtained of the effects on the juice quality of plant canes of soaking the setts in solutions of copper and manganese sulphates, in the presence and absence of a manurial dressing with phosphate.

Cultural methods.

77. Confirmatory evidence is now available that forking of ratoon canes can have a serious adverse effect on juice quality.

6. SOIL INVESTIGATIONS WITH SPECIAL REFERENCE TO MANURIAL TREATMENT.

Manuring with Potash.

78. As a result of field experiments with plant canes and ratoons reaped from 1933 onwards at Brechin Castle, Bronte, Caroni, Esperanza, Orange Grove, Ste. Madeleine, Waterloo and Woodford Lodge Estates, it is possible to make definite recommendations for manurial treatment of sugar cane with potash on non-calcareous soils.

Plant canes.

79. Response in yield to dressings of potash is doubtful if the soil contains more than 90 parts per million of exchangeable potash as K_2O.

80. Paying response should result from dressings of 1 cwt. of potash to the acre if the soil contains from 55 to 90 parts per million of exchangeable K_2O.

81. Paying response should result from dressings of two or more cwts. of potash to the acre if the soil contains less than 55 parts per million of exchangeable K_2O.

Ratoon canes.

82. If it is necessary to apply potash to plant canes, it is also advisable to apply potash to the ratoon crops which follow. The dressing to ratoons may be increased to 1½ or 2 cwts. when the amount of available potash in the soil is less than 55 parts per million of exchangeable K_2O.

83. It is essential for the potash to be applied early in the lives of the plant canes and ratoons.

Soil Surveys.

84. The field-to-field soil surveys, which were mentioned in my Annual Reports for 1935, 1936 and 1937, are still actively under way and have been extended to another estate. Officers from the various estates have been trained in my laboratory in the methods of measurement of soil requirement of lime and potash. The manurial programmes with lime and potash of the interested estates are based on the results of these surveys.

7. SOIL SURVEY WITH SPECIAL REFERENCE TO THE ALLOCATION OF VARIETIES.

85. During 1938 a special investigation was undertaken, with the assistance of Mr. C. F. Charter, the primary object of which was to determine the fundamental differences between soils capable of producing paying yields of noble canes and soils on which it is only profitable to grow hardy canes, and on the basis of these studies to put forward suggestions with regard to the future allocation of varieties.

86. The investigation was carried out under the aegis of the Sugar-Cane Investigation Committee and with the aid of a grant from the Colonial Development Fund.

87. The soils of representative areas of the sugar estates were examined by means of profile pits and auger borings and the mechanical composition and base status of the samples collected were measured in the laboratory. The different soils encountered have been described and classified into types, series and suites.

88. The following soil suites have been provisionally recognised :—

Frederick Suite.—Soils developed over recent marine swamp clays and characterised by their high clay contents (80-95 per cent.) and by the occurrence in their profiles of black horizons of organic matter.

Washington Suite.—Soils developed over recent river alluvium of a silty or sandy nature. The silt contents of these soils are very high, frequently exceeding 35 per cent. Soils in this suite typically display a characteristic decrease in heaviness of texture down the profile which exerts an important influence on the supply of moisture to the growing plant during dry periods.

Waterloo Suite.—Soils developed over red-mottled or brown-mottled clays of marine origin and pleistocene age. These clays have been highly leached during the past and are in general very deficient in bases.

Devenish Suite.—Soils developed over a layer of sand, about two feet in thickness, which overlies clays similar to those encountered beneath the soils of Waterloo Suite.

Ste. Madeleine Suite.—Soils developed over calcareous or non-calcareous marine clays of miocene age and occurring in regions of very undulating topography. These soils are characterised by a content of clay which exceeds 70 per cent. and by the occurrence of deposits of gypsum and calcium carbonate in various parts of the profile in certain of the included series.

Hermitage Suite.—Soils developed over miocene marls in regions of undulating topography.

The suites so far mentioned include soils with profile characters which have been largely determined by seasonal drainage impedance.

Esperanza Suite.—Free-draining soils usually red in colour and of a sandy or loamy texture developed over several lithological deposits. This suite comprises a relatively small sugar-cane area under estate cultivation.

89. It has been found that soils suitable for the economic growth of noble canes are characterised by their good or relatively good base-status, particularly their lime status, throughout the profile ; whilst soils suitable for hardy canes, or hybrids containing a certain proportion of hardy characters, are characterised by a poor lime-status throughout the profile. These two main groups can be further sub-divided into categories (suitable for noble canes, for hybrids of noble and hardy canes or for hardy canes) on the basis of their capacity for natural drainage and their ability to supply moisture to the crop during rainless periods. These properties depend very largely upon the mechanical composition of the various horizons comprising the soil profile and to a certain extent upon the topographical position of the soil.

90. Soils suitable for the growth of noble canes are found in Hermitage Suite, Washington Suite, Frederick Suite (types or phases with good lime status), Ste. Madeleine Suite (series developed over calcareous parent materials), and in Waterloo Suite (Cunupia Series only).

91. Soils suitable for the growth of hybrids of noble and hardy canes occur in Ste. Madeleine Suite (series developed over non-calcareous parent materials), Frederick Suite (types or phases with poor lime-status), and Waterloo Suite (with the exception of Cunupia Series).

92. Soils suited only to the growth of hardy canes are present in the Waterloo, Devenish and Esperanza Suites.

93. An account of the past and present distribution of sugar-cane varieties on sugar estates in Trinidad and of the factors influencing their distribution, a detailed classification and description of the sugar-cane soils and their varietal characteristics, and recommendations based on the results of this investigation for the future allocation of the main types of sugar-cane varieties, are included in the following publication of the Sugar-Cane Investigation Committee—*A preliminary survey of soil types of sugar estates of Trinidad with special reference to the allocation of sugar-cane varieties*, by P. E. Turner and C. F. Charter.

8. MISCELLANEOUS.

Educational.

94. The following addresses were given to the Cultivation Committee of the Sugar Manufacturers' Association during the course of the year. The Committee, of which I am Chairman, consists of the senior members of the field staffs of the estate. :—

Soil types of the sugar areas with special reference to the allocation of varieties, by Mr. C. F. Charter.

High-power dusting for froghopper control, by the Entomologist to the Department.

Manuring with potash, by the Sugar Agronomist to the Department.

Visits to Grenada.

95. Two intransit visits were paid to Grenada to supervise the experimental scheme on sugar cane in operation in this island and to decide on its future course.

Visits to Louisiana and Florida.

96. I attended the Sixth Congress of the International Society of Sugar-Cane Technologists, which was held in Louisiana, as the delegate of Trinidad and of the Sugar-Cane Investigation Committee. I am pleased to report that at the Congress I was elected Regional Vice-Chairman of the B.W.I. Section of the International Society.

97. After the Congress I paid a visit to the United States Sugar Corporation at Clewiston, Florida.

98. The visits to Louisiana and Florida were a very valuable experience, and I was able to bring back information which I hope will be put into standard estate practice in Trinidad.

99. I should like to place on record my thanks to the Sugar-Cane Investigation Committee for providing me with the facilities for these visits.

9. PUBLICATIONS.

Field experiments on sugar cane in Trinidad. Annual report for 1938.

List of cultural, manurial and varietal experiments on sugar cane in operation in Trinidad, 1938.

A preliminary survey of soil types of sugar estates of Trinidad with special reference to the allocation of varieties :—

I.—The distribution of varieties on sugar estates in Trinidad.

II.—Soils of Trinidad sugar estates (by C. F. Charter).

III.—The relationship of Trinidad soils to sugar-cane varieties (with C. F. Charter).

P. E. TURNER,
Sugar-cane Agronomist.

PART III.

ANNEXURES.

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PART III—ANNEXURES.

APPENDIX A.

Revenue and Expenditure.

	Expenditure. £ s. d.	*Revenue.* £ s. d.
HEAD OFFICE :		
Personal Emoluments	9,108 2 1	
Travelling and other Charges	1,456 3 8	40 0 0
Laboratory Expenses and Field Experiments...	387 18 7½	10 0 0
BOTANICAL DEPARTMENT, TRINIDAD :		
Personal Emoluments	506 17 9½	
Upkeep, Royal Botanic Gardens and St. Clair Station ...	1,499 15 11	
Care of Trees on Government Lands	210 0 8½	
Upkeep, Red House Grounds	512 2 7½	
BOTANICAL DEPARTMENT, TOBAGO :		
Personal Emoluments, Travelling	111 16 7	
Maintenance, Botanic Station and Government House Grounds...	483 19 3½	53 19 6
ST. AUGUSTINE NURSERY :		
Personal Emoluments	1,095 12 6	
Maintenance and Other Charges	3,084 6 8	2,047 18 9½
MARPER FARM :		
Maintenance	1,034 18 9	673 5 9
RIVER ESTATE :		
Personal Emoluments	1,322 10 0	
General Maintenance, &c.	3,628 19 0½	
Improvement	838 7 6½	3,371 6 5½
ST. AUGUSTINE EXPERIMENT STATION :		
Personal Emoluments	762 8 0	
Maintenance, Cultivation of Crops, &c.	1,841 2 3	235 16 11½
GOVERNMENT FARM, TRINIDAD :		
Personal Emoluments	1,299 9 5	
Maintenance	5,400 4 11	
Purchase of Stock (Trinidad and Tobago)	2,051 0 0½	6,897 18 0½
GOVERNMENT FARM, TOBAGO :		
Personal Emoluments	100 0 0	
Maintenance	1,385 13 0	405 3 7½
GOVERNMENT VETERINARY SURGEON :		
Assistant Examiners and Contingencies	959 0 10	
Paralytic rabies	541 3 7½	1,922 18 0
QUEEN'S PARK AND PASTURES :		
Personal Emoluments	182 7 7	
Maintenance	1,136 11 0	
Improvements, Queen's Park Savannah	341 19 7	225 13 1
DISTRICT SERVICE :		
Personal Emoluments, Travelling, &c.	14,089 10 11	
PLANT PROTECTION ORDINANCE :		
Control of Plant Diseases and Pests	4,363 1 11½	
Witchbroom Resistant Cocoa Research	924 19 8½	
AGRICULTURAL CREDIT SOCIETIES :		
Travelling, &c.	632 8 2	
TOBAGO ABATTOIR :		
Maintenance, Travelling, &c.	123 14 7½	71 2 4
SOIL SURVEY :		
Personal Emoluments	728 2 10½	
Maintenance	369 13 7	
Survey of the Cocoa Industry	149 10 4½	
Total	£62,663 14 3	£15,955 2 6½

APPENDIX B.

Agricultural Exports, Trinidad and Tobago.

	1938		1937	
	Quantity.	Value.	Quantity.	Value.
		£		£
CACAO :				
Raw Cacao	42,436,447 lb.	493,601	26,258,622 lb.	643,123
SUGAR CANE AND PRODUCTS :				
Refined	1 ton	29	...	...
Vacuum pan, Grey Crystal	93,419 tons	774,062	120,552 tons	1,059,420
Do. White Crystal	½ ton	7	...	...
Do. Yellow Crystal	18,956 tons	200,953	15,882 tons	168,585
Molasses Crystal	4,196 tons	31,974	2,498 tons	17,726
Yellow Crystal Molasses	3,655 tons	25,583	3,813 tons	28,288
Molasses	2,523,645 gals.	29,050	4,258,934 gals.	45,953
Rum	63,051 gals.	12,358	109,860 gals.	18,720
Bitters	13,299 gals.	23,914	12,870 gals.	23,537
Dark Molasses	30 tons	300	...	...
COCONUT AND PRODUCTS :				
Coconuts	2,245,302 No.	6,786	5,020,665 No.	20,693
Copra	9,387,616 lb.	40,463	17,277,008 lb.	113,083
Coconut Oil	20,919 gals.	1,790	19,918 gals.	2,292
COFFEE :				
Raw Coffee	687,731 lb.	8,438	1,752,882 lb.	28,074
TONKA BEANS	52,656 lb.	17,463	71,539 lb.	21,593
RUBBER :				
Raw Rubber	158,771 lb.	4,738	175,648 lb.	7,644
LIMES :				
Limes	1,039 brls.	1,767	923¾ brls.	1,592
Lime Juice	77,392 gals.	4,920	30,862 gals.	2,100
Lime Oil	34,341 lb.	24,592	47,651 lb.	48,098
Citrate of Lime	200,332 lb.	3,438	203,728 lb.	2,358
GRAIN, PULSE, STARCHES, &C. :				
Corn (Maize)	48,496 lb.	226	48,272 lb.	206
Peas and Beans	3,862 lb.	34	250,320 lb.	1,737
FRUIT :				
Grapefruit	79,660 boxes	66,300	45,772 boxes	39,078
Grapefruit—Hearts and Juice (Canned)	...	17,116	...	8,654
Oranges	3,697,562 No.	5,605	3,116,970 No.	3,674
Bananas	80,506 No.	9,174	157,740 No.	16,027
Other Kinds	...	229	...	37
MISCELLANEOUS :				
Plants and Seeds	...	1,222	...	257
Fresh Vegetables	14,260 lb.	60	8,624 lb.	41
Other Nuts	534 lb.	10	322 lb.	24
Cereals	...	...	4 cwt.	7
Farinaceous Preparations	108 cwt.	104	1 cwt.	1
Spices (Nutmegs)	15,481 lb.	201	10,668 lb.	122
Mace	1,359 lb.	44	840 lb.	39
Honey	12,062 lb.	156	17,569 lb.	169
Livestock	...	783	77 No.	988
Feeding Stuff	653 tons	2,809	492 tons	1,976
Hides and Skins	1,640 cwt.	4,020	1,725 cwt.	3,620
Leather (unmanufactured)	2,543 lb.	143	4,480 lb.	246
		£1,814,462		£2,329,782

APPENDIX C.

ANNUAL RAINFALL 1862 TO 1938, PORT-OF-SPAIN, TRINIDAD.

1862 to 1899 at the Royal Botanic Gardens. January, 1900 onwards at the closely adjacent St. Clair Experiment Station.

Year.	Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Annual Rainfall.
	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Ins.	Inches.
1862 ..	..	.66	.77	.25	1.41	8.47	10.36	9.57	11.97	6.60	10.06	3.03	63.15
1863 ..	1.54	2.71	1.45	.85	1.26	9.12	10.12	10.53	12.11	6.24	4.30	6.57	66.80
1864 ..	2.51	.53	.36	.04	8.15	4.96	7.17	12.06	8.04	6.53	5.94	6.61	62.90
1865 ..	2.62	3.20	1.07	7.98	3.22	5.64	10.35	14.83	7.32	14.62	4.81	9.62	85.28
1866 ..	2.24	3.91	1.44	1.09	1.45	6.59	7.83	12.34	5.87	10.11	8.17	6.82	67.86
1867 ..	1.31	6.36	.83	1.32	2.33	5.30	12.20	15.21	10.45	7.87	.67	2.71	66.56
1868 ..	2.06	.82	3.20	.64	4.17	7.78	11.35	6.73	5.46	4.66	8.31	1.03	56.21
1869 ..	.08	.93	.74	.41	.69	5.52	10.17	8.74	8.86	5.15	6.30	5.87	53.46
1870 ..	2.61	.56	1.46	1.51	4.65	8.81	11.91	9.00	10.63	3.98	5.94	8.29	69.35
1871 ..	6.62	1.40	2.89	.92	3.97	8.84	11.73	12.97	7.87	4.37	10.73	3.27	75.58
1872 ..	1.45	.07	.74	.39	3.14	7.09	5.45	10.82	3.07	4.80	9.89	3.04	49.95
1873 ..	1.78	1.08	1.98	.53	..	4.31	5.04	8.37	5.80	10.34	3.48	1.31	44.02
1874 ..	3.47	1.96	3.67	5.16	2.51	12.28	12.28	11.20	9.38	6.42	3.66	4.29	76.28
1875 ..	3.39	.91	.56	.42	2.61	4.15	12.62	7.22	11.95	10.85	3.74	2.48	60.90
1876 ..	3.26	1.03	1.78	1.67	6.65	11.17	12.23	15.18	12.03	7.04	5.95	3.96	81.95
1877 ..	2.14	..	7.46	3.38	3.19	8.43	8.35	12.94	6.39	6.68	7.66	5.48	72.10
1878 ..	3.44	.70	..	3.22	4.99	5.78	5.42	8.88	11.15	5.89	8.72	3.05	61.24
1879 ..	1.52	2.76	4.56	3.03	3.08	14.92	6.86	10.35	6.15	3.54	4.28	4.38	65.43
1880 ..	11.72	6.53	.67	2.32	3.90	7.83	6.30	17.39	7.47	5.74	10.51	1.96	82.34
1881 ..	.57	.65	.23	1.60	4.66	11.05	7.82	10.90	10.59	3.36	12.06	2.23	65.72
1882 ..	1.33	2.38	.73	1.57	3.74	6.33	5.93	8.40	4.93	5.86	10.29	1.50	52.99
1883 ..	1.56	.71	.26	3.37	5.89	10.91	13.66	10.26	5.53	3.99	6.06	8.30	70.50
1884 ..	3.43	2.50	4.40	1.51	2.91	6.84	5.71	8.70	5.03	5.05	5.14	5.66	56.88
1885 ..	1.30	.89	1.49	.43	5.27	3.44	5.87	4.56	6.08	4.08	5.37	4.44	43.22
1886 ..	3.32	1.97	3.27	3.83	4.49	9.70	17.48	8.15	6.73	12.59	8.54	6.75	86.82
1887 ..	2.69	1.46	1.67	1.08	3.98	7.40	5.51	9.93	5.07	5.84	7.60	11.86	64.09
1888 ..	8.37	1.79	2.41	2.28	3.46	11.92	6.89	7.02	5.53	5.06	7.76	2.95	65.44
1889 ..	.94	.85	4.16	1.05	6.34	11.66	12.14	11.73	3.76	6.30	7.38	7.48	73.79
1890 ..	7.76	.51	2.09	7.62	5.14	9.68	12.89	11.65	3.37	10.98	5.93	5.28	82.90
1891 ..	3.17	.92	.03	1.44	2.54	5.54	11.88	4.26	7.44	5.77	6.66	4.09	53.74
1892 ..	1.93	2.19	1.85	7.59	11.55	16.26	15.55	9.21	3.57	11.49	5.40	4.69	91.28
1893 ..	3.43	1.85	.19	3.61	11.35	10.19	13.28	16.32	11.73	5.47	7.84	7.23	92.49
1894 ..	3.22	2.36	3.12	1.22	2.69	3.26	4.53	12.06	5.48	3.93	7.28	3.16	52.31
1895 ..	2.52	1.33	2.27	2.52	2.11	5.00	2.57	4.86	5.69	10.89	15.15	7.32	62.23
1896 ..	7.08	.88	1.59	2.33	1.62	10.29	6.35	7.66	6.46	6.05	9.81	6.33	66.45
1897 ..	1.67	.75	3.96	.26	5.58	11.19	13.88	7.90	9.83	8.87	9.39	4.40	77.68
1898 ..	3.05	2.18	2.10	1.17	1.49	6.46	5.87	10.55	7.13	6.15	9.13	3.57	58.85
1899 ..	1.95	1.82	1.00	.75	.52	7.63	4.44	8.45	2.18	6.34	8.07	3.61	46.76
1900 ..	3.56	.76	2.72	4.10	4.14	12.99	7.95	11.07	5.52	6.53	5.41	2.61	67.36
1901 ..	1.95	1.51	1.85	.35	6.45	9.21	8.38	7.53	4.26	4.97	7.93	4.83	59.22
1902 ..	2.56	.51	1.18	1.78	2.14	10.05	5.20	11.67	7.22	7.40	2.74	2.89	55.34
1903 ..	1.51	.68	1 54	2.17	.95	5.42	9.40	9.45	11.41	2.12	2.59	4.20	51.44
1904 ..	3.00	2.56	4.24	2.50	2.76	6.23	8.03	4.72	8.81	5.65	3.61	4.32	56.43
1905 ..	2.41	.59	3.74	1.79	4.34	6.01	9.49	11.09	10.43	6.94	10.69	4.16	71.68
1906 ..	.43	.50	.73	.46	7.96	10.95	11.42	8.55	6.54	6.80	5.00	5.64	64.98
1907 ..	5.22	.44	1.71	.09	4.58	11.01	11.02	5.77	7.76	7.65	10.69	4.10	70.04
1908 ..	.75	.45	1.79	.95	5.82	5.22	5.87	7.72	5.45	5.45	2.65	8.68	50.80
1909 ..	5.69	2.43	1.15	1.78	3.87	8.31	10.72	6.29	6.95	7.15	3.93	6.31	64.58
1910 ..	2.79	4.38	1.75	2.01	2.76	6.34	6.40	13.89	8.27	9.21	8.49	1.90	68.19
1911 ..	1.61	1.51	1.86	.74	1.27	7.15	5.20	13.68	4.03	10.22	3.57	3.53	54.37
1912 ..	.62	Nil.	.74	.03	2.18	7.54	12.16	5.56	5.87	2.73	6.28	5.64	49.35
1913 ..	2.80	.50	1.42	.42	1.79	2.80	2.86	6.48	6.52	3.51	8.61	1.82	39.53
1914 ..	.50	.61	1.28	1.01	2.05	7.34	5.05	9.15	7.80	6.14	7.61	5.58	54.12
1915 ..	2.10	.66	..	2.63	2.76	7.05	12.76	5.27	4.21	9.28	7.84	1 75	58.31
1916 ..	5.29	1.35	1.57	1.91	.94	10.30	8.04	11.57	10.78	6.68	9.32	1.98	69.73
1917 ..	1.17	3.06	1.38	.50	4.24	6.30	10.13	9.96	7.24	5.43	6.61	8.22	64.24
1918 ..	3.15	1.18	1.48	1.27	2.94	5.87	14.42	8.56	8.93	5.51	7.56	3.85	64.72
1919 ..	.62	..	1.78	1.67	3.50	6.78	5.17	6.82	7.96	7.79	8.42	6.67	57.18
1920 ..	1.39	1.66	.94	.28	.56	4.13	4.93	6.70	10.98	5.74	6.03	1.60	44.94
1921 ..	2.43	1.60	5.03	4.09	1.43	9.91	10.06	10.30	10.17	6.53	7.71	6.25	75.51
1922 ..	4.01	1.13	1.41	2.39	2.18	6.10	5.06	8.35	6.49	2.92	11.17	7.10	58.31
1923 ..	1.91	1.66	.96	2.97	1.46	3.48	10.76	9.37	6.23	4.41	7.38	7.32	57.91
1924 ..	1.54	.90	.14	1.11	.73	4.95	7.53	7.27	4.59	7.81	8.56	2.15	47.28
1925 ..	1.77	1.06	2.67	.10	1.21	4.20	7.58	8.87	6.37	5.85	5.36	4.36	49.40
1926 ..	.69	.39	.54	.23	2.12	5.26	5.25	10.85	11.20	14.78	9.71	7.56	68.58
1927 ..	4.71	4.44	3.62	5.04	7.15	6.95	9.40	11.67	9.11	6.13	5.64	7.21	81.07
1928 ..	4.22	.69	2.31	2.02	.67	5.75	8.07	8.66	7.36	9.13	8.42	5.94	63.24
1929 ..	.84	.84	1.78	.81	7.33	6.43	5.10	8.90	5.21	3.40	9.30	1.51	51.45
1930 ..	2.70	.08	.31	2.38	1.85	6.35	7.12	4.94	5.82	6.27	2.59	4.87	45.28
1931 ..	1.68	1.11	.07	.29	1.12	6.94	10.96	8.89	4.85	6.59	7.94	5.77	56.21
1932 ..	5.61	1·72	4.33	3.99	9.25	10.53	5.80	16.04	3.85	4.60	10.23	8.01	83.96
1933 ..	3.87	1.25	1.91	1.36	2.85	10.19	9.93	16.07	11.52	7.41	5.38	6.29	78.03
1934 ..	2.51	.90	.7,	.17	.82	3.05	9.43	7 24	6.55	8.50	10.08	5.30	55.35
1935 ..	0.53	0.57	1.23	0.42	5.03	2.36	7.35	13.23	11.41	3.82	11.25	3.45	60.65
1936 ..	1.16	0.28	0.11	2.43	5.62	10.52	11.33	5.93	8.13	4.95	7.06	5.53	63.05
1937 ..	3.62	1.24	.70	2.59	.20	4.33	7.09	8.69	5.41	4.17	12.08	7.88	58.00
1938 ..	3.50	2.63	3.95	6.45	6.79	5.87	9.65	10.15	11.61	7.49	10.32	11.73	90.14
Grand Total ..	211.01	111.94	139.11	147.64	272.51	582.01	672.06	743.82	568.89	507.16	563.74	383.13	4,901.54
Av. for 77 years	2.74	1.46	1.81	1.91	3.54	7.56	8.72	9.66	7.39	6.58	7.32	4.97	63.66

APPENDIX D.

AGRICULTURAL LABOUR.

RATES OF WAGES.

The following table gives the wage rates in force on agricultural estates at the end of 1937. Labour on sugar estates received about 12½ per cent. more than in 1938.

SUGAR.

Factory Workers.

Skilled Labour	...$1.00 to $1.60 per day, 8-8½ hours.
Semi-Skilled Labour	...$ .70 to $ .95 per day, 8-8½ hours.
Unskilled Labour	...$ .55 to $ .65 per day, 8-8½ hours.

Cultivation.

Operation.	*Size of Task.*	*Rate.*	*Average daily earning.*
Cutlassing	30 rods	35c.	35-40c.
Forking	18-20 rods	45c.	45-65c.
Banking	28-32 banks	45c.	45-65c.
Lining	per acre	40-45c.	80-1.00
Planting	1,200/1,500 plants	40-45c.	45-60c.
Cutting Plants	1,000/1,200 plants	35c.	35-50c.
Draining	25/30/40c. per chain	—	80-1.00
Weeding	Varies	35c.	35-50c.
Carting Pen Manure	8-9c. per ton	—	70c.
Head Pen Manure	150 baskets	35c.	35c.
Cutting Canes	Varies	35c.	35-70c.
Carting Canes	14c. per ton	— Cartermen	80-1.00
		Loaders	40-50c.
Small Gang	day of eight hours	20-30c.	—
Applying Artificial Manure	do.	25c.	—
Stockkeepers	do.	75-90c.	—
Stockmen	do.	50-55c.	—
Grooms	do.	50-60c.	—
Tractor Drivers	do.	$1.60-1.90	—
Ploughmen	do.	80c.	—
Watchmen	do.	50-55c.	—
Loading—Derrick hands	do.	55-60c.	—

COCOA.

Cutlassing per 100 trees			...40-50c.
Pruning per 100 trees		...Light	...50-65c.
		Heavy	...80c.-1.20
Draining per 100 feet		...Lateral	...40c.-60c.
		Main	...40c.-1.00
Picking and breaking			...60c.-$2.40 per barrel depending on the quantity of ripe cocoa at the time of picking.

Day rates average approximately 45c. for an 8-8½ hour day for men and 30c.-35c. for women. On coconut, citrus and other estates the rates paid follow generally those paid on cocoa estates.

GOVERNMENT ESTATES.

Minimum rates for an eight hour day :—

Port-of-Spain ... ... 60 cents. Country ... ... 45 cents.

NOTE.—In estimating the average daily earnings of any class of agricultural labourer it must be remembered that the greater part of the work performed on estates is task work. A task is completed in approximately four to five hours and labourers can, if they so desire, increase their daily earnings by undertaking an additional half a task or a second task.

In addition to actual cash payments, a number of estates provide a proportion of their regular labourers with free barrack accommodation, fuel and other perquisites.

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